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ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

1894.

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1895.

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No. 85.] JANUARY. [1894.

CCCLIII.—GUMMING OF THE SUGAR-CANE IN NEW SOUTH WALES.

Inquiries having been addressed to Kew with respect to a disease of the sugar-cane which has made its appearance in New South Wales, the only authentic account of it which is at present available is re-printed in the *Kew Bulletin* for general information. This is contained in the Annual Report (1893) of the Department of Agriculture of the Colony (pp. 8–10). The statement has been drawn up by Dr. Cobb, Pathologist to the Department.

The disease is attributed to the agency of a bacterium ("microbe"). This is not improbable, though it does not appear to have been actually proved.

The part played by bacteria in producing plant diseases is still very imperfectly understood. *Bacillus Amylobacter* feeds on and destroys the flesh of succulent fruits, potatoes, &c. The best ascertained case is, however, that of a disease of Hyacinths, due to a yellow bacillus. This develops in the fibro-vascular bundles of the bulb, especially in the vessels. It eventually ascends into the leaves, fills the inter-cellular passages, and finally penetrates the epidermis.

In the United States the destructive diseases known as "Pear Blight" and "Peach Yellows" have been attributed, with some probability, to the action of bacteria.

The Department of Agriculture has, with commendable judgment, indicated the only practical remedy by impressing on the farmer the paramount importance of securing healthy "sets" for planting.

EXTRACT from the ANNUAL REPORT, 1893 (pp. 8–10), of the DEPARTMENT of AGRICULTURE, NEW SOUTH WALES.

Five weeks, inclusive of the month of July, were spent on the Clarence River. Upwards of 30 possible causes of disease in cane were examined with care. These included half a dozen different species of fungi, and upwards of 20 species of nematodes. Neither the fungi nor the nematodes are doing any such amount of damage as would cause the complaints which are to be heard everywhere on the Clarence River.

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The disease so bitterly complained of turns out to be associated with th presence of a microbe in the sap-vessels of the cane. The presence the microbes is indicated to the eye by the exudation on fresh surfaces of a yellow gummy substance. The disease which I pro to call *the Gumming of the Sugar-cane*, never occurs without presence of this gummy matter.

The gummy matter never occurs without the microbes, and is, in fact, a product of their growth. It is impossible to enter into details here; but, from very careful and minute examination, I came to the conclusion that there are very strong and exceedingly numerous reasons for supposing the disease to be caused by these microbes, which are a new sort, and which I propose to call *Bacillus vascularum*, but no one is entitled to say that any organism is the cause of any given disease until the organism has been inoculated into healthy individuals, and there produced the disease, and such inoculation must, of course, have been made under the now well understood modern precautions against the introduction of any other organism or disease-producing factor. Such inoculations have been made, and the result will in due time be recorded. Meanwhile, we know from these investigations much about the nature and symptoms of gumming that will enable the cane-growers on the Clarence to put several checks on the losses they have hitherto suffered from it.

These methods of checking the disease were fully explained to a representative meeting of farmers from all parts of the river, and were such as to meet their approval. Chief among them was greater care in securing healthy sets.

Not knowing the objectionable nature of this gum the farmers have been planting sets containing it, and the resulting crops have been diseased in consequence. I was able to show that the buds of gummed sets already contain the microbes and the gum, or, in other words, are already diseased, so that the growers were shown to be setting out diseased plants.

Practical directions, accompanied by numerous specimens, were given to the growers, whereby they could distinguish readily and with certainty whether their sets were gummed, and these directions were such as to meet with warm approval. While pointing out the ability of any farmer to select his own sets, I doubted whether many farmers on the Lower Clarence would find on their farms sets sufficiently free from gum. I, therefore, strongly advised them to adopt some system by which an expert might have access to all farms on the river, wherefrom to select and buy plant-cane at a reasonable price, the same to be sold by him at a profit. If such selection were done with care, the resulting sets would be worth more than is ordinarily paid for plant-cane (namely, 1*l.* per ton). If we set the expert's price at 30*s.* per ton, and reckon for the Lower Clarence 700 tons per annum of cane for planting, there is a living for one man in the business. He should charter a launch and two or three punts, and hire a gang of cutters.

Having examined and selected his cane, he would then be in a position to deliver to order plant-cane certified to be reasonably free from gum. Whoever enters the undertaking must have first qualified himself to select cane plants free from gum and other blemishes, and must have both energy and business capacity. At planting time his resources would be heavily taxed. At other seasons he should make himself familiar with the cane fields, and decide from whence he would draw his supplies of plant-cane. To qualify himself for selecting cane, he should familiarise himself with the appearances of sound cane of every variety in demand; he should make himself familiar with the diseases of cane, especially gumming.

My advice was that he should furnish plant-cane of two sorts:—

1. Cane in stalks selected from as healthy crops as possible (by the examination of stalks from here and there all through the field).

2. Cane sets, *i.e.*, already cut up, the same to be culled in the most careful manner after rigid inspection, and to be as healthy and free from gum as possible.

No. 1 could be sold at 30*s*. per ton—possibly less; this would depend on the patronage of the growers.

No. 2 would have to be sold at a much higher price, and would be used by the growers for nursery purposes.

The Lower Clarence would furnish, I believe, a living for one plant-cane specialist; the whole Clarence for more than one. The farmers were warned to bear in mind that the disease exists in all fields on the river, so that the matter of securing non-gummed sets is of interest to the up-river farmers as well as the down-river farmers.

The distribution of the disease is as follows, as far as at present known:—

1. *General.*

(*a*.) On the Clarence River.
(*b*.) On the Richmond River.
(*c*.) In all probability in Queensland.

2. *Local on the Clarence.*

While gummed cane is common all along the river, it is much more common on the Lower Clarence, and the gumming is there much worse than above the town of Maclean.

I believe I examined nearly all the varieties of cane at present grown on the Clarence River. No variety examined was perfectly free from gum, though a long search had to be made in some cases to find it. It is very noticeable that the varieties recently introduced are much more healthy, as far as gumming is concerned, than those long in use. Nearly every stalk of some of the new introductions was found to be free from even traces of gum. On this ground, as well as others, the introduction and trial of new varieties is strongly to be commended. This department has done well during the past few years to import and distribute to cane growers varieties from Queensland, Fiji, New Guinea, and Louisiana. I made numerous drawings of the fungi examined, and the nematodes and other injurious organisms seen during the progress of the work as well as of the microbes and the different features of gumming. About 125 photographs, mostly micro-photographs, were taken, and numerous specimens obtained. Although I have given the disease the name "gumming," I do not mean to imply that the honey-coloured substance produced by the growth of the *B. vascularum* is a gum in the chemical sense of the word. I tested this substance chemically in many different ways, and its reactions differ from those of the group chemically known as gums. I am satisfied that it is in the main composed of a definite chemical compound to which I have given the name *vasculin*.

The detailed reactions of vasculin, the particulars of the life history of *B. vascularum*, the full particulars of the disease gumming of sugar-cane so far as known, together with numerous illustrations, will be submitted in the full report, as well as full details of all the practical conclusions, the latter of which it has here been possible only to briefly sketch.

Judging from the account given by Dr. Cobb, the New South Wales sugar-cane disease appears to be very closely allied to, if not identical with, a disease called "gomziekte," attacking the sugar-cane in Java, and which has been investigated by Krüger,* Valeton,† and Janse.‡ The symptoms, also the general characteristics, of the disease are identical, as is also the final result, the formation of gum in the fibro-vascular bundles, and the presence of a bacterium, which in the Java disease was called *Bacillus sacchari*, Janse; this has since been identified by Went with the "hay bacillus," *Bacillis subtilis*.

Dr. Cobb has given the detailed account of his investigation of "Gumming of the Sugar-cane" in the October number of the *Agricultural Gazette* of New South Wales (pp. 777–798).

CCCLIV.—DECADES KEWENSES.

PLANTARUM NOVARUM IN HERBARIO HORTI REGII CONSERVATARUM.

DECAS VII.

61. **Cochlearia Conwayi**, *Hemsl.* [Cruciferæ]; herba perennis? pusilla, ramosa, gracillima, glabra vel minutissime puberula, foliis linearibus angustissime spathulatis obtusis vel pinnatifidis paucilobatis, floribus ut videtur aurantiacis laxissime racemosis longe graciliterque pedicellatis, sepalis æqualibus ovato-oblongis, petalis angustis, filamentis tenuibus deorsum dilatatis, ovario glabro longiore quam lato.

Habitat.—Karakoram: Doyen to Ramghat, *W. M. Conway*, 305.

Herba circiter 2 poll. alta. *Folia* 3–5 lin. longa. *Flores* circiter 2 lin. longi, petalis quam sepala duplo longioribus.

62. **Ruta (§Haplophyllum) Gilesii**, *Hemsl.* [Rutaceæ]; lignescens, caulibus multiramosis, ramis teretibus primum minute puberulis siccitate pallide viridibus, foliis parvis subsessilibus linearibus vel angustissime spathulatis integris apice obtusis vel rotundatis deorsum attenuatis, cymis terminalibus densis, pedicellis brevissimis, sepalis minutis tenuissimis parce minuteque puberulis orbicularibus, petalis anguste ovato-oblongis obtusissimis dorso carinato-incrassatis, filamentis deorsum dilatatis infra medium barbatis, ovario 3-loculari (an semper?) styloque villosulo, loculis 4-ovulatis.

Habitat.—Gilgit, south of Hindu Kush, at 4,500 feet, *Dr. Giles;* Karakoram: upper branch of the Bagrot valley, *W. M. Conway.*

Herba erecta circiter pedalis. *Folia* vix semipollicaria. *Flores* 4–5 lin. diametro. *Sepala* minuta. *Petala* circiter 2½ lin. longa.

63. **Pilocarpus microphyllus**, *Stapf.* [Rutaceæ]; foliis imparipinnatis 2–3-jugis oppositis, foliolis parvis glaberrimis terminali petiolulato excepto sessilibus ellipticis vel obovato-ellipticis basi acuminatis apice emarginatis, nervis lateralibus primariis utrinque circiter 4 eximie sub marginem arcuatim connectis tenuioribus interjectis utrinque tenuiter

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* Mededeel. van het Proefstation West-Java; I. 1890, p. 130.

† Bijdrage tot de Kennis der serehziekte; Proefstation Oost-Java, 1891.

‡ Mededeel. van 'sLands Plant., IX., 1891.

prominulis pellucido- et præterea subtus nigro-punctatis, petiolo communi superne anguste alato, racemis tenuibus laxifloris, floribus parvis breviter pedicellatis glabris, calycis lobis minutis ovatis, stylo brevissimo, stigmate 5-lobulato inter ovarii lobos subsessili, coccis oblique ovoideis rugosis.

Habitat.—Environs of Rio Janeiro ? *Glaziou*, 13,417.

Petiolus communis, 2½–½ poll. longus, *foliola* circiter 1 poll. longa, ½ poll. lata. *Flores* (juniores in alabastris maturis) ¾ lin. longi.

Leaves of this species were sent recently to Kew for identification, by Evans, Sons, and Co., Liverpool. They were said to have been received from Brazil, and were marked "Jaborandi." They agree perfectly with those of *Glaziou's* specimen, 13,417, which has an inflorescence attached to it. The structure of the flowers is that of typical *Pilocarpus*; they, are, however, very small. The cocci are described from a single specimen found amongst the leaves sent from Liverpool. They are very like those of *Pilocarpus pennatifolius*, Lem., but oblique ovoid, not obovoid, being widest below the middle. The leaves are very characteristic, being much smaller than in any previously known species.

64. **Cassipourea verticillata**, *N. E. Brown* [Rhizophoreæ]; glabra, foliis verticillatis 3–4-nis petiolatis oblongis utrinque obtusissimis vel basi cuneatis apice subacutis, marginibus leviter crenato-serratis vel subintegris, venis primariis utrinque 8–10, floribus in- axillis foliorum dense fasciculatis verticillatis pedicellatis albis, pedicellis medio articulatis, calyce infundibuliformi-campanulato 6–7 dentato, dentibus triangulatis acutis quam tubo duplo brevioribus, petalis 5–7 exsertis angustissime cuneatis apice fimbriatis adpresse pubescentibus, staminibus 10–14 basi monadelphis, ovario ovoideo apice dense hirsuto 2-loculari, loculis biovulatis, stylo exserto, stigmate bilobo, capsulis oblongis subcarnosis quam calyce duplo longioribus bivalvibus 1–2-spermis, seminibus pendulis ellipsoideis, testa subcrustacea in arillo amplo flavo involutis, albumine copioso carnoso, embryone centrali recto, cotyledonibus planis ovato-lanceolatis.

Habitat.—Natal, near Pinetown, 1,000 ft., *Wood*, 3876, and near Durban, *Wood*, 4619.

Arbor parva. *Petiolus* 4–6 lin. longus, lamina 3½–4½ poll. longa, 1½–2¼ poll. lata. *Pedicelli* 1½–2 lin. longi. *Calyx* 2 lin. longus. *Petala* 2½ lin. longa, ⅙ lin. lata. *Fructus* 2½ lin. longus.

I cannot find any character of generic importance to separate the African *Dactylopetalum* from the American *Cassipourea*, and therefore have placed this plant under the older name of *Cassipourea*, to which genus I consider the species of *Dactylopetalum* should be transferred. *C. verticillata* is probably nearly related to *C. gummiflua* Tul., a Madagascar species I have not seen, and also bears considerable resemblance to *Dactylopetalum Barteri*, Hook, f., but is readily distinguished from all known species by its verticillate leaves, which are sometimes 3, sometimes 4 in a whorl.

65. **Rhododendron Fordii**, Hemsl. [Ericaceæ]; species ex affinitate *R. Fortunei* et *R. brachycarpi* sed foliis minoribus basi cuneatis etc.; ramulis floriferis tortuosis glabris apice tantum foliiferis, foliis distincte petiolatis coriaceis utrinque glabris lanceolatis oblanceolatis vel oblongis obtusissimis vel rotundatis deorsum attenuatis subtus pallidis, squamis sub floribus arcte imbricatis subdistichis elongatis obtusis glutinosis glabris, corymbis paucifloris gracilibus, floribus albis pedunculatis, pedunculis ferrugineo-puberulis, calyce brevissimo obtuse minuteque lobulato, corolla sæpius 5-lobata lobis rotundatis, staminibus 10, filamentis infra

medium parce puberulis, ovario ferrugineo-furfuraceo 5-loculari stylo breviter exserto, capsula ignota.

Habitat.—Lantao Island, Kwangtung, China; *C. Ford's* native collector.

Folia cum petiolo 2–3½ poll. longa et ½–1¼ poll. lata. *Pedunculi* circiter semipollicares. *Flores* circiter 1½ poll. diametro.

66. **Ardisia megaphylla**, Hemsl. [Myrsinaceæ]; frutex caule simplici (fide *Horne*) undique glaber, foliis amplissimis brevissime petiolatis coriaceis anguste lanceolato-oblongis obtusis basi rotundato-auriculatis integris subtus pallidioribus margine incrassato costa crassissima venis primariis distantibus inter se conjunctis et cum vena intramarginali anastomosantibus, paniculis angustis pseudo-terminalibus, floribus breviter pedicellatis, calycis segmentis erectis deltoideis vix acutis, corolla staminibusque ignotis, fructu magno globoso.

Habitat.—Rambi or Rabi, Fiji. *J. Horne*, 429, and Viti Levu, *D. Yeoward*, 1.

Folia usque ad 3 ped. longa et 7 poll. lata. *Inflorescentia* cum pedunculo circiter pedalis. *Calycis* segmenta lineam longa. *Fructus* semipoll. diametro.

A handsome species allied to *A. grandis*, Seem, but that has a cuneate base to the leaf, reflexed calyx-lobes, and a smaller fruit.

Mr. Yeoward, in a letter, dated October 1893, states that his specimens were brought in by his native collectors from about one or two miles inland, on the south side of Viti Levu; and he continues:—"The "natives say it grows to 100 feet straight up, almost without a break, "and they call it 'Dacea.' My specimens were taken from a small "tree cut down about 4 feet high, and brought in by my men." There is probably some mistake here, and Mr. Yeoward's final remark is, perhaps, ambiguous. Mr. Horne describes it as a shrub with a simple stem, common in the forests of Rabi.

67. **Solanum muticum**, N.E. Brown [Solanaceæ]; *S. lento* affine, caule erecto ramoso angulato pubescenti pilis simplicibus, foliis petiolatis lanceolatis acuminatis apice subobtusis basi in petiolum cuneatis viridibus molliter pubescentibus pilis simplicibus vel furcatis nec stellatis, floribus pedicellatis umbellato-fusciculatis in axillis foliorum vel in furcis ramorum vel terminalibus, calyce cyathformi 5–10 dentata pubescenti dentibus filiformibus alternis minoribus infra apicem tubi affixis, corolla late infundibulariformi magna pentagona plicata violacea glabra apice dentorum pubescenti, staminibus 5 subæqualibus corolla ter brevioribus, filamentis brevissimis, stylo staminibus æquilongo apice arcuato leviter incrassato, bacca ?

Habitat.—Paraguay (cultivated in Monte Video), *Gibert*, 56 and 641.

Petiolus ⅓–¾ poll. longus, *Lamina* foliorum 1¼–3 poll. longa, ½–1¼ poll. lata. *Pedicelli* ½–¾ poll. longi. *Calycis tubus* 1–1½ lin. longus, dentibus 1–3 lin. longis. *Corolla* 1–1½ poll. diam. *Stamina* 2–2½ lin. longa.

Specimens of this plant were first sent to Kew by Gibert in 1858, with a note that it is a native of Paraguay, but is cultivated in Monte Video as an ornamental plant. Living specimens were received from Glasnevin Botanic Garden in September 1872, and in the same month of 1893 it was sent to Kew by Messrs. Dammann & Co., who received it from Buenos Ayres. But it does not appear to have been previously described or recorded, unless it has been mistaken for *S. lentum*, Cav., which is a much more woody plant with terete (not angular) stems and one of the stamens about twice as long as the other four. To judge from the dried specimens, *S. muticum* is rather a showy free flowering species, and likely to prove a useful plant for summer bedding.

68. **Aniba perutilis**, *Hemsl.* [Lauraceæ]; ramulis ultimis graciliusculis, cortice cinereo primum puberulo cito glabrescenti, cataphyllis numerosis ovato-oblongis obtusis fusco sericeis, foliis parvis distincte petiolatis coriaceis adultis glabris subtus glaucis vel opacis supra vix nitidis lanceolatis vel oblanceolatis obtusissimis vel rotundatis basi cuneatis, venis primariis utrinque circiter 7–9 inconspicuis, pedicellis incrassatis, inflorescentiæ ramulis pubescentibus, perianthii pubescentis lobis crassis brevissimis rotundatis, tubo intus villoso, antheris bilocellatis, ovario glabro, bacca matura ellipsoideo-conica basi fere truncata perianthii tubo valde incrassato corrugato cupuliformi subinclusa.

Habitat.—Near Medellin, Antioquia, Colombia, *W. Gordon*, Esq., H.B.M. Vice-Consul (1893).

Folia cum petiolo circiter semipollicari 2½–3½ poll. longa. *Pedicelli* 3–4 lineas longi. *Bacca* cum cupula circiter semipollicem longa et diametro.

This is one of two or three species of Laurel bearing the name of "Comino" in Colombia, and highly valued there for the excellent timber they yield. *Aniba perutilis* is called "Laurel Comino," according to Mr. Gordon; but the name is not confined to this species, there being in the Kew Herbarium a very different species of *Aniba* (*Aydendron*), the 2,040 of the late Dr. Triana's collection, from the very same region, to which he gave the name of "Laurel Comino." There is also a "Comino Crespo," referred to in a report (1892) by Mr. Luciano Santa Maria, Vice-Consul for the United States at Medellin.

69. **Trichomanes vestitum**, *Baker* [Hymenophyllaceæ]; rhizomate filiformi late repente, stipitibus brevissimis remotis paleis paucis subulatis præditis, frondibus ovatis profunde pinnatifidis basi cuneatis utrinque praesertim ad costas hispidulis margine integris, pinnis paucijugis basi confluentibus centralibus 3–5-lobis, soris paucis ad pinnarum marginem superiorum sessilibus, indusio sub-cylindrico, ore patulo vix lobato, receptaculo incluso.

Habitat.—Mount Guding, Sarawak, Borneo, *Bishop of Sarawak and Singapore*, 266, (July 1893).

Lamina 6–12 lin. longa, 4–6 lin. lata.

Nearly allied to *T. humile* and the small forms of *T. pyxidiferum*, and resembling in habit and vestiture the tropical American *Hymenophyllum hirsutum*.

70. **Lomaria egenolfioides**, *Baker* [Polypodiaceæ]; caudice erecto, frondibus biformibus dense cæspitosis subcoriaceis glabris lineari-oblongis simpliciter pinnatis, stipitibus elongatis gracilibus brunneis nudis frondorum fertilium longioribus, pinnis sterilibus linearibus obtusis crenatis basi utrinque auriculatis, inferioribus deflexis sensim minoribus, venis remotis erecto-patentibus immersis obscuris superioribus simplicibus inferioribus furcatis, pinnis fertilibus remotioribus multo minoribus.

Habitat.—Mount Dulit. Sarawak, Borneo, *Chas. Hose* (1891). Sent to Kew by the Bishop of Sarawak and Singapore in July 1893 as No. 309.

Lamina sterilis 5–6 poll. longa, medio 12–15 lin. lata, stipite 1½–2-pollicari. *Lamina fertilis* 8–9 lin. lata, stipite 4–5-pollicari.

A very distinct species, much resembling in habit the common tropical Asian *Acrostichum* (*Egenolfia*) *appendiculatum*.

CCCLV.—WEST AFRICAN MAHOGANY.

For some time past a considerable amount of attention has been directed to the timber resources of Tropical Africa (see *Kew Bulletin* for February 1891, p. 41), and under the name of African Mahogany, a dark reddish coloured wood, having some of the characters of true mahogany, has appeared in the English market. This timber has been proved to be the produce of *Khaya senegalensis*, a tree belonging to the same natural order as Central American Mahogany. More recently, however, it seems that the term African Mahogany has been applied in British commerce to other woods than that furnished by *Khaya senegalensis*, and, in reference to this subject, Mr. James Irvine, of the firm of Irvine and Dundas, of Liverpool, has kindly furnished the Royal Gardens with some notes, which are here printed.

It is obvious that there is still much confusion as to the botanical sources of some of these woods, as will be seen from the comments made in square brackets.

JAMES IRVINE, Esq., to ROYAL GARDENS, KEW.

That this wood was to be found in large quantities on the Gold Coast of Africa has been known for some time.

Sir Richard Burton mentions it in his "To the Gold Coast for Gold," where, at page 159, Vol. II., he says: "There is an ample supply of " good hard timber, and amongst the trees are specially noted the copal, " the gamboge rich in sticky juice, the Brovi, said to be the hardest " wood, and the dum or African Mahogany (*Oldfieldia africana*), well " known in Ceylon as excellent material for boat-building."

[The copal tree here referred to is probably a species of *Copaifera*, the gamboge tree is doubtless *Symphonia globulifera*, L., which affords the well known "Hog" or "Doctors'" gum of Jamaica. The scientific name of the tree called "Brovi" we are unable to trace. There seems to be an error in referring the native name *dum* and African Mahogany to *Oldfieldia africana*, Bth., which furnishes the African Oak or Teak of commerce, a timber used for ship-building; it is extremely heavy and of a dark brown colour. "Dum" is probably synonymous with "Odum," the native name applied to *Chlorophora excelsa*, Bth. and Hook, f. It is a tree belonging to the natural order Urticaceæ. See *Kew Bulletin*, February 1891, p. 44.]

Sir Alfred Moloney, in his work on the "Forestry of West Africa," gives a much more extended reference to it [West African Mahogany].

The importation of this wood commenced in Liverpool in the autumn of 1886, and during that year about 250 tons were received, and in the following three years the supplies ranged from 150 to 250 tons, whilst 700 tons came forward in 1890. From that date the import has gone on by leaps and bounds, as we find that 1891 gave 4,300 tons, to be followed in 1892 by about 7,500 tons, and for the present year the import has been quite 50 per cent. more than that for 1892, foreshadowing at least 11,000 to 12,000 tons for the 12 months ending December next.

It meets with an immediate sale, and the fortnightly auctions clear off the import of one steamer before the next arrives.

The trees are to be found over an extent of coast line of quite 200 miles, running back into the interior 80 to 100 miles, and through the whole of this region the numberless creeks, rivers, and lagoons afford a ready and economical mode of transit to the home-going steamers.

[This reference would seem to apply to various trees known generally as West African Mahogany, and not to any one particular species.]

There are said to be six kinds of mahogany trees known to the natives by the following names :—

Papáo,
Bako,
Dubin,
Kwabaha,
Chire-ankama,
Odum.

[Neither of these names, excepting Odum, which is referred to above, are contained in our lists of African plant names.]

But the consumers in England do not appear to know any distinction.

The last mentioned is the wood which Burton calls *Oldfieldia africana*, but Moloney speaks of it [*Oldfieldia*] as the African Oak of Sierra Leone.

Mr. Austin Freeman, in an article read before the Royal Geographical Society, and published in the Supplemental Papers, Part II., 1892, says : "The peculiar shape of the forest trees renders them especially easy to " manipulate, for if a large tree such as Odum is felled, and its trunk " disengaged from the mass of branches at its summit, there remains a " straight cylindrical log from 90 to 120 feet in length."

The Odum is a tree which reaches a height of fully 200 feet, with a diameter of 5 to 10 feet. It yields a wood similar to oak in texture and hardness, and varying in colour from a golden yellow to a deep brown.

[From a comparison of the woods of African Oak (*Oldfieldia africana*), English Oak (*Quercus Robur*), and Odum (*Chlorophora excelsa*), contained in the Kew Museum, they seem to be of different densities and degrees of hardness, and might be classified as enumerated above.]

The Papáo is a somewhat smaller tree, giving a wood almost indistinguishable from Spanish Mahogany.

Bano (Bako) is a tree similar in size to Papáo, and its wood is of the same character, but has the reputation of being more even in texture and more easy to work.

Freeman adds that a careful examination of the forest would, no doubt, reveal the presence of many other trees yielding valuable woods, and it may be confidently stated that before long a very remunerative timber trade will be established in West Africa, and concludes as follows :—" From a review of the above-stated facts, and from a con" sideration of the great wealth of the country in natural productions, " of the possession by it of a soil and climate which respond to the " feeblest efforts of agriculture with the most lavish productive" ness, and of the evidence afforded by the small but flourishing plan" tations which already exist, of its suitability for the cultivation of " coffee, cocoa, cotton, and many other valuable articles of trade, it will, " I think, be manifest that the Gold Coast and its adjacent territories " will, in the near future, assume a commercial importance in striking " contrast to their present insignificance."

[An article appeared in the August number of the *Kew Bulletin* for 1890, p. 168, on Gambia Mahogany (*Khaya senegalensis*, A. Juss).]

September 27, 1893.

CCCLVI.—TUBEROUS LABIATÆ.

It has long been known that certain species of *Labiatæ* have tuberous rootstocks, and also that two or three of them were cultivated in the East for the sake of their tubers, but it is only during the last ten years that Europeans have given much attention to these plants as a possible source of food. An enumeration of those species of the two principal genera yielding tubers, viz., *Coleus* and *Plectranthus*, will be useful as indicating what species might be found worthy of experimental cultivation.

The earliest record of the use of the tubers of a labiate plant as an article of food, is by Rumphius in his *Herbarium Amboinense*, vol. 5, p. 372 (published in 1750, although written over 50 years previously, according to the author's preface, which is dated 1695). Rumphius describes and figures a labiate plant under the name of "*Glans terrestris costensis*," stating that it was cultivated in Java, Amboina, &c., and the tubers cooked in various ways and eaten. This is *Coleus tuberosus*, Benth., which seems to be very little known in Europe up to the present time. The next records of esculent tuberous Labiatæ are respectively those of *Plectranthus ternatus*, in 1824 ; *Coleus tuberosus*, Rich., not of Benth. (*C. edulis*, Vatke) in 1851 ; *Coleus barbatus*, in 1861, and *Stachys Sieboldi* (S. tuberifera *Naud*). in 1885, which is closely allied to our native *S. palustris*. Besides these there are several other *Labiatæ*, belonging to several distinct genera, that produce tubers, some of them abounding in starch, others destitute of it. In this enumeration, however, only those members of the genera *Coleus* and *Plectranthus* are dealt with that are known or stated to produce tubers, with the exception of two new species, which from their habit are in all probability tuberous and are therefore included.

Coleus barbatus, *Benth.* in *Wall. Pl. Asiat. Rar.* ii., p. 15 and in *DC. Prod* xii., p. 71 ; *Dalz. and Gibs. Bombay Fl.* p. 205.

Plectranthus Forskolæi, *Willd. Sp. Pl.* iii., p. 169 ; *Bot. Mag.* t. 2036.

Plectranthus barbatus, *Andr. Bot. Rep.* t. 594.

A native of India, Arabia and East Tropical Africa.

According to Dalzell and Gibson's Flora, and a label of Dr. Ritchie's in the Kew Herbarium, this plant is cultivated in the Deccan for the sake of its fleshy roots, which are pickled by the natives.

Coleus dysentericus, *Baker.*—Radice tuberosa globosa, caulibus erectis ramosis sparsissime pubescentibus vel subglabris, foliis petiolatis ellipticis basi cuneatis paucicrenatis carnosis ? glabris subtus nigro-punctatis, cymis interdum breviter pedunculatis multifloris remotis in racemum elongatum nudum dispositis, pedicellis brevibus pubescentibus, calycis tubo campanulato dente superiore magno ovato, reliquis parvis ovatis, corolla parva extus pilosa.

Hab.—Niger region, Zomba, *Barter*, 846.

Caulis subpedalis. *Folii petiolus* $\frac{1}{8}$–$1\frac{1}{4}$ poll. longus, *lamina* $\frac{1}{2}$–2 poll. longa, $\frac{3}{8}$–$1\frac{1}{4}$ poll. lata. *Calyx* floriferus 1 lin. longus. *Corolla* $2\frac{1}{2}$ lin. longa.

Barter makes the following statement on his label :—" Root tuberous, " 1 foot. This is cultivated and used in cases of dysentery. Zomba " name '*Krodyn.*' " The tuber attached to the specimen is about an inch in diameter, is fleshy, and the cells are densely filled with starch.

Coleus edulis, *Vatke* in *Linnæa* xxxvii., p. 319.

C. tuberosus, *Richard Fl. Abyssin.* ii., p. 185, not of *Benth.*

A native of Abyssinia, where, according to Quartin Dillon (Richard, *loc. cit.*), it is largely cultivated under the name of *Daunech* in the numerous gardens around the village of Kouaieta at an elevation of 6,000–7,000 feet above sea level. The tubers are said to resemble and taste like potatoes, and, to judge from the specimen in the Kew Herbarium, appear to be freely produced and abound in starch grains. According to Vatke, *loc. cit.*, Schimper collected this plant at an elevation of 8,200 feet, so that it is probable it might be successfully cultivated in this country, and as the tubers appear to be of good size, should be worthy of a trial.

Coleus lanuginosus, *Hochst.* ex *Benth.* in *DC. Prod.* xii., p. 79.

C. albidus, *Vatke* in *Linnæa* xxxvii., p. 321.

A native of Abyssinia.

This plant produces small tubers that are fleshy and filled with starch.

Coleus tuberosus, *Benth. Labiatæ*, p. 59, and in *DC. Prod.* xii., p. 79; *Miquel Fl. Ind. Bat.* ii., p. 953; *Gard. Chron.* 1893, xix., p. 183.

C. parviflorus, *Benth.* in *DC. Prod.* xii., p. 72; *Hook. fil.*, *Fl. Brit. Ind.* iv., p. 625.

Plectranthus tuberosus, *Blume Bijdr.* p. 838; *Thwaites Enum. Ceylon Pl.*, p. 238.

Glans terrestris costensis, *Rumph. Herb. Amboin*, v., p. 372, t. 132, f. 1.

The native country of this plant is somewhat doubtful. It is cultivated in Java, Amboina, and other islands of the Malay Archipelago, and in Ceylon, where, according to a note by Gardner in the Kew Herbarium, it is "cultivated like potatoes by the natives." Thwaites also states that the Cinghalese cultivate it "for the sake of " its tuberous roots, which are eaten as a vegetable." Rumphius gives rather a full account of the plant, stating that it is eaten boiled and roasted, and had been recently introduced into Amboina from Java and Baly. He further suggests that it was probably introduced into the islands from the Malay Peninsula. On the other hand he tells us that the common name employed by the Portuguese for the plant is " *Gotte* " *Kelingan* or *Gotte Kelin*, probably because it is much cultivated on the " Coromandel coast, the inhabitants of which are called *Kelin* or *Quellin*." Neither Roxburgh nor Wight and Arnot, however, mention the plant in their works, although there are specimens in the Kew Herbarium collected by Wight, at Quilon (No. 2105, Wight, Kew distribution), but the labels do not state whether it was wild or cultivated. Plants of it are now in cultivation at Kew, and a note concerning it appeared in the *Kew Bulletin* for 1892, p. 313.

In the *Revue des Sciences Naturelles Appliquées*, 1891, p. 684, is a short account of a labiate sent to Paris from the Transvaal by Mingard in 1884, under the name of *Pomme de terre sauvage*, or *Matambala* of the Magwambas. Two tubers of the plant were taken by M. Pierre to the French Congo Colony, where it has increased with great rapidity and is now cultivated, and according to M. Pierre, it is known in the interior and on the coast under the name of *Pomme de terre de Madagascar*. Some of the tubers were cultivated in the Jardin des Plantes, Paris, where the plant flowered and was identified as *Coleus tuberosus*, Benth. The history is, however, not free from doubt, as there is no evidence that *Coleus tuberosus* has been introduced into the Transvaal or is cultivated there, and the name Wild Potato, under which it was sent to Paris, would imply that it is not a cultivated plant, but a native of the Transvaal. This is a point that requires further elucidation, as it is possible, as previously stated in the *Kew Bulletin* (1892, p. 314), that it may prove to be identical with the "Kaffir Potato" (*Plectranthus esculentus*, described below), or possibly with *Coleus edulis*, Vatke, an Abyssinian species described by Richard as *C. tuberosus*.

Plectranthus densus, *N. E. Brown.* P. floribundo omnino simili sed differt racemis brevioribus et densioribus, bracteis obovatis vel oblanceolatis quam pedicellis duplo longioribus, calyce æqualiter quinquifido dentibus omnibus lanceolatis acuminatis. Folia desunt.

HAB. Tropical Africa; higher plateau, North of Lake Nyassa, *Thomson.*

Racemi 1–1½ poll. longi. *Bracteæ* 1½–2 lin. longæ. *Pedicelli* ¾–1 lin. longi. *Calyx* 2–2½ lin. longus. *Corolla* 5 lin. longa.

Plectranthus esculentus, *N. E. Brown.* Radice tuberosa, caulibus demum decumbentibus pubescentibus, foliis subsessilibus oblongis obtusis basi cuneato-angustatis utrinque minute pubescentibus venis primariis subtus parum prominentibus tempore florentis omnino delapsis, racemis solitariis vel fasciculatis simplicibus scabridis bracteatis ex axillis foliorum delapsorum enatis, bracteis oppositis ellipticis obtusis scabridis pedicellum æquantibus vel brevioribus, calyce campanulato scabrido inæqualiter quinquifido dente postico elliptico-ovato obtuso reliquis lanceolatis acuminatis, corolla calyce plus duplo excedente lutea compressa inæqualiter bilabiata tubo basi brevissime gibboso labio superiore brevissimo 4–dentato labio inferiore falcato-cymbiformi subacuto pubescente, staminibus liberis.

HAB. Natal *Wood,* 3,633.

Caules subpedales. *Folia* 1¾–3 poll. longa, ½–1 poll. lata. *Racemi* ¾–1 poll. longi. *Bracteæ* 1 lin. longæ et latæ. *Pedicelli* 1–2½ lin. longi. *Calyx* 1½–2 lin. longus. *Corolla* 7 lin. longa.

Specimens of this plant were first sent to Kew by Mr. J. M. Wood, the Curator of the Botanic Garden, Durban, in November 1886, under the name of "Umbondive or Kaffir Potato," with a note stating that "the natives are very fond of the tubers." Living tubers have also been sent by Mr. Wood, and the plant is now in cultivation at Kew. According to Mr. Wood the stems are decumbent, but under cultivation at Kew, they are at first quite erect, afterwards bending towards the ground and branching.

Plectranthus floribundus, *N.E. Brown.* Caule elato erecto sublignoso pubescente, foliis sessilibus oblongis obtusis basi obtuse rotundatis marginibus subcrenatis utrinque subscabridis venis subtus prominente reticulatis tempore florentis omnino delapsis, racemis solitariis vel fasciculatis elongatis multifloris simplicibus vel ramosis scabridis bracteatis ex axillis foliorum delapsorum enatis et paniculam elongatam nudam simulantibus, bracteis oppositis obovato-ellipticis subacutis scabridis pedicellum scabridum æquantibus, calyce campanulato scabrido inæqualiter quinquifido dente postico late elliptico obtuso reliquis lanceolatis acuminatis, corolla calyce plus duplo excedente lutea compressa inæqualiter bilabiata, tubo basi brevissime gibboso, labio superiore brevissimo 4–dentato, labio inferiore falcato-cymbiformi subacuto pubescente, staminibus liberis.

HAB.—Natal, Inanda 1,800 feet alt., *Wood*, 646, 3843.

Caulis 2–4 pedalis, parte florifera 1–1½ ped. longa. *Folia* 2–3 poll. longa, ¾–1¼ poll. lata. *Racemi*, 1½–2½ poll. longi. *Bracteæ* 1½ lin. longæ, 1–1¼ lin. latæ. *Pedicelli* 1½–2 lin. longi. *Calyx* 3 lin. longus. *Corolla* 7 lin. longa.

Var. **longipes**, *N.E. Brown.* Pedicellis quam bracteis 1½–3 plo longioribus; corolla aurantiaca dimorpha, aliæ profunde falcato-cymbiformes, aliæ rectæ minus alte cymbiformes.

HAB.—Tropical Africa: Manganja Hills, 1,000–2,000 feet alt., *Meller;* Maravi Country, West of Lake Nyassa, *Kirk;* lower plateau of Lake Nyassa, *Thomson; Buchanan*, 885; Blantyre, *Scott;* valley of Umzingwani River, *Baines;* Angola, Cunene, *Johnston.*

Caulis 8–12 pedalis. *Bracteæ* 1–2 lin. longæ. *Pedicelli* 2–5 lin. longi. *Corolla* 5–9 lin. longa.

This species is closely allied to *P. esculentus*, but differs in its more erect habit, taller stems, and closely sessile leaves, with broader rounded bases, rather rougher surface, and more prominent reticulation. The tropical variety *longipes* may prove to be a distinct species when the leaves are known, but in everything except the length of the pedicels it agrees with the Natal plant.

As in the case of several other Labiatæ, the corolla shows considerable variation; two specimens collected by Meller at the same place and time have very different corollas; in one it is only five lines long, with the lower lip straight and very shallowly boat-shaped, in the other it is 8–9 lines long with the lower lip falcate and deeply boat-shaped; possibly they are sexual forms.

The three species of *Plectranthus* described above, together with *P. defoliatus*, Hochst., form a small group differing from all the rest of the genus by the peculiarity of flowering after the leaves have all fallen away. Possibly they are all tuberous rooted species, but *P. esculentus* is the only one which affords evidence of this. The leaves of all but the Natal plants are at present unknown. Although all have the same habit, it is noteworthy that, whilst *P. densus* and *P. defoliatus* have all the calyx-teeth equal, and belong to the section *Isodon*, the others have the large elliptic upper calyx-tooth of the section *Coleoides*, with which they also agree in the form of their corolla.

Plectranthus incanus, *Link Enum.* II., p. 120; *Hook. fil.*, *Fl. Brit. Ind.*, IV., p. 621. *Plectranthus cordifolius*, Don Prod. Fl. Nep., p. 116; and *Benth.* in *DC. Prod.* xii., p. 66. This Indian plant is stated by Bentham to have a tuberous root, but this is certainly an error. None of the other authors who have described the plant under various names say that it is tuberous. Link describes it as a perennial, and Aiton as an annual, and this last appears from the specimens to be its true character.

Plectranthus madagascariensis, Benth. *Labiatæ*, p. 38, and in *DC. Prod.* xii., p. 68; *Baker, Fl. Maurit.*, p. 258. *P. mauritianus*, *Bojer*, Hort. Maurit., p. 254. This plant is mentioned by several authors (*Naudin and Mueller, Manuel de l'Acclimateur*, p. 428; *Mueller, Select Extra-tropical Pl.*, ed. 8, p. 371; and *Paillieux et Bois* in *Rev. Scien. Nat. Appliq.*, 1891, p. 686), as a tuberous-rooted Labiate cultivated in Madagascar, Mauritius, and the East Coast of Africa, under the name of *Oumime* or *Houmime*. But in all probability this is an error, and the plant intended is most likely *Plectranthus* *ternatus*, Sims., which is known as the *Omime*. There appears to be no evidence from specimens or descriptions that *P. madagascariensis* produces tubers. On the contrary, Bojer states that it is called *Omime sauvage* or *Omime bâtard*, which would imply that it is not cultivated.

Plectranthus Sieberi, *Benth. Lab.* p. 710, and in *DC. Prod.* xii., p. 68.

This is a native of Australia, and in the original description is stated by Bentham to have the roots thickened at the apex, but the specimen does not bear out this statement, at least they do not appear to be tuberous. No mention of *P. Sieberi* is made by Bentham in the *Flora Australiensis ;* it is however the same as *P. parviflorus*, Willd.

Plectranthus ternatus, *Sims, Bot. Mag.* t. 2,460; *Bojer, Hort. Maurit*, p. 253 ; *DC. Prod.* xii., p. 65.

A native of the Comoro Isles and Madagascar, whence it was introduced into Mauritius and cultivated for the sake of its tubers under the name of *Omime*. In the *Botanical Magazine* the tubers are figured as about 1¼ inches long, by ½ an inch thick, and thickest at one end. They are described as being " esteemed as a choice and delicate esculent."

It is not improbable that this will prove to be the plant which is alluded to by recent authors as *P. madagascariensis.*, concerning which more information is required.

CCCLVII.—VEITCH COLLECTION OF JAPANESE VEGETABLE PRODUCTS.

Through the liberality of Mr. James H. Veitch, F.L.S., the Museum of the Royal Gardens has recently been enriched by the whole of the fine and extensive collection of vegetable products made by him during his recent travels in Japan. This collection is not only very extensive, but it is also very varied, and contains many things that are extremely interesting and quite new to the Museum. The few notes here given are but a brief record of the uses of some of the principal products selected from the list which accompanies them.

NYMPHÆACEÆ.

Nelumbium speciosum, Willd.—Pressed fruit head or receptacle used as a mat for heated kettles.

TERNSTRŒMIACEÆ.

Stachyurus præcox, S. & Z.—Dye extract, a resinoid substance probably prepared from the wood.

TILIACEÆ.

Tilia cordata, Mill.—Getta or sabots made of the wood ; also specimens of the inner bark used for tying and rope used as harness for farmers' horses.

ANACARDIACEÆ.

Rhus succedanea, L.—Samples of wax bought at Osakaya as follows:—

1. Refined white wax similar in appearance to beeswax, used for polishing wood by joiners, and also in the preparation of pomade. Price $12·50 per 100 lbs. Japanese.

2. Bungo green wax used in the manufacture of candles. Price 11·85 per 100 lbs. Japanese.

3. Chikugo grey wax used to make candles. Price $$10\frac{25}{100}$$ per 100 lbs. Japanese.

LEGUMINOSÆ.

Wistaria chinensis, DC.—Young climbing stems used for binding bamboos to form windows for summer-houses.

Glycine hispida, Maxim.—Horsehair sieve used in the manufacture of soy from the seeds of this plant.

Phaseolus Mungo, L. var *radiatus*.—Meal prepared from the pod used to make chocolate.

Sophora japonica, L.—Tray and small ornamental table made of the wood, which is also used in joinery and as a dye.

ROSACEÆ.

Pyrus Toringo, Sieb.—Sample of the bark which is employed as a yellow dye.

SAXIFRAGACEÆ.

Hydrangea paniculata, Sieb.—Tobacco pipes made of the wood.

CUCURBITACEÆ.

Luffa Petola, Ser.—Vascular tissue of the fruit used as a sponge.

EBENACEÆ.

Diospyros Kaki, Lin. fil.—Astringent acid obtained from the unripened fruits. It is used as a preservative solution for planks for buildings and also by fishermen for dressing their nets.

SCROPHULARINEÆ.

Paulownia imperialis, S. & Z.—Getta or sabots made of the wood This wood is light and soft and is in extensive use for a variety of purposes.

CHENOPODIACEÆ.

Kochia scoparia, Schrad.—Broom made of the plant.

LAURINEÆ.

Lindera sericea, Bl.—Volatile oil used as a perfume and recommended for soapmaking.

SANTALACEÆ.

Santalum album, L.—Sliced wood prepared for burning as a perfume also "burning incense"; this is generally prepared from sandal-wood clover, dried and powdered leaves of *Illicium religiosum*, S. et Z., and burnt on festival days (a custom known in India and China, especially among Buddhists).

URTICACEÆ.

Cannabis sativa, L.—Kwaso bark made into rope to form the soles for sandals; also samples of rope of various sizes.

Broussonetia papyrifera, Vent.—Circular mats or seats made of paper prepared from the bark of this plant, for summer use. Bowl made of paper and lacquered; also threads of paper covered with gluten, used by Japanese ladies for dressing the hair.

Morus alba, L.—Trays made of the wood. The wood is brownish-yellow, hard, and used for turnery, dyeing, &c.; the bark is made into paper.

JUGLANDEÆ.

Pterocarya rhoifolia, S. & Z.—Box and trays made of the wood.

CUPULIFERÆ.

Betula Maximowiczii, Regel.—Sample of bark used for making baskets and basket made of same.

Alnus firma, S. &. Z.—Ornamental box of the wood with carved lid. The wood is used for sledges, mills, machinery, turnery, &c.

Quercus crispula, Bl.—Getta or sabots of the wood of *Paulownia imperialis*, S. & Z., with uprights of the wood of this species of oak, which is also used in the construction of canoes, and for charcoal.

SALICINEÆ.

Salix multinervis, Fr. & Sav.—Lunch basket formed of the twigs. Larger baskets are made for use in travelling.

CONIFERÆ.

Chamæcyparis obtusa, S. & Z. [Thuja obtusa, *Mast.*]—Mats made of shavings. The wood is used for building purposes, shipbuilding, bridges, &c. The bark is used as shingles for the roofing of houses and junks.

Cryptomeria japonica, Don.—Box with carved lid made of the wood; also specimen of the semi-fossilized wood found on a hill hear Sendai, where it is known as "Jindaisugi." Various fancy articles are manufactured from it at Sendai, those contained in the present collection being of excellent workmanship. The wood of *C. japonica*, is very extensively employed in Japan for heavy work, the bark being used for roofing, &c.

An interesting addition to the Museum collections forming part of the present donation consists of very small glazed earthen pots for holding artificially dwarfed pines and other plants.

CYCADACEÆ.

Cycas revoluta, Thunb.—Hat made of the leaves. This is ingeniously and neatly made; the leaf itself is used, the petiole forming the framework of the hat, the pinnæ being interwoven.

PALMÆ.

Trachycarpus excelsus, Wendl. [Chamærops excelsa, *Thunb.*]—Fibre obtained from the sheathing base of the leaves of this palm; also ropes, mats, and brushes manufactured from the fibre. This palm is known as the Chinese Hemp palm; examples of the varied application of its fibre are already in the Museum collection.

GRAMINEÆ.

Miscanthus sinensis, Anders. [Eulalia japonica, *Trin.*]—Brushes made of the roots, which somewhat resemble Venetian or French Whisk (*Chrysopogon Gryllus*, Trin.).

Carved ornamental box made of one joint of Bamboo, the nodes forming the ends. The lid is closed by an ingenious contrivance of the handle.

FILICES.

Gleichenia glauca, Sw.—Fancy tray and nest of tea boxes formed of the leaf stalks of this fern; the tea boxes are lined with tin. These specimens illustrate a new application for this order of plants, and form an interesting addition to our collections.

Osmunda regalis, L.—Rhizome, used as food in Japan; it is boiled in soy (a kind of sauce prepared from the seeds of *Glycine hispida*, Maxim.) and eaten with salt.

Pteris aquilina, L.—The rhizome of this species is also used as food in Japan. Specimens as used, and rope made of the stems, used by gardeners, are contained in the collection.

CCCLVIII.—DIAGNOSES AFRICANÆ, I.

The Flora of Tropical Africa was commenced by Professor Oliver, F.R.S., the late keeper of the Herbarium and Library of the Royal Gardens. Its general plan was uniform with that of the series of Colonial Floras which, at intervals during the last 30 years, have been prepared at Kew. Vol. I. was issued in 1868; Vol. II. in 1871; and Vol. III. in 1877. The different orders were elaborated either by Professor Oliver himself or by other botanists.

In the preface to Vol. I., Professor Oliver, writing in 1868, writes:—
" The more original feature of the 'Flora of Tropical Africa' is based
" upon the very extensive collection that have accumulated at Kew
" during the last 10 years, sent home by the botanists and collectors
" attached to various scientific and exploratory journeys in Tropical
" Africa."

Since the date of publication of the last volume, the enormous development of the Herbarium, and the pressing necessity of keeping fresh accessions determined scientifically and incorporated in it, has left the staff no time for other work, and such extraneous aid as was available has been mostly absorbed in assisting Sir Joseph Hooker in his Flora of British India, now approaching completion, and in other undertakings.

The recent delimitation of the spheres of influence of the various European Powers in Tropical Africa has given necessarily an increased impulse to exploration and commercial enterprise, and this in turn has suggested to the Government the desirability of resuming work upon the "Flora of Tropical Africa." The following correspondence has taken place upon the subject:—

FOREIGN OFFICE to ROYAL GARDENS, KEW.

Foreign Office,
March 21, 1891.

SIR,

I AM directed by the Marquess of Salisbury to state to you that his attention has been called to the fact that three volumes only of the "Flora of Tropical Africa" have as yet been published, and that the want of a complete handbook describing known plants impedes their study by Her Majesty's officers in the different parts of Africa which are now being opened up to civilization. A knowledge of African botany is of great practical value, as was proved by the discovery by Sir John Kirk, whilst employed as Her Majesty's Agent at Zanzibar, of a plant, previously unknown, which now supplies annually 200,000*l.* worth of india-rubber to the Zanzibar market. So, too, on the West Coast of Africa, the trade consists almost entirely of vegetable products, some of which have only recently been brought to light.

Lord Salisbury is of opinion that a proper knowledge of the Flora of Tropical Africa would do much to aid the development of the territories over which this country has recently acquired an influence, and he would therefore suggest that the completion of the work in question should at once be carried out.

I am, &c.
(Signed) T. V. LISTER.

The Director,
Royal Gardens, Kew.

ROYAL GARDENS, KEW, to FOREIGN OFFICE.

Royal Gardens, Kew,
March 28, 1891.

SIR,

I HAVE the honour to acknowledge the receipt of your letter of March 21 respecting the completion of the Flora of Tropical Africa. This work, as you are no doubt aware, is published under the authority of the First Commissioner of Her Majesty's Works, and I have forwarded your letter to him with a request for instructions.

2. Apart from an official difficulty which may arise, but which in the face of Lord Salisbury's strong opinion will no doubt be easily overcome, I am embarrassed by the want of competent persons, with time at their disposal, to carry on the work. Our small scientific staff here is so fully occupied with routine duties that it is impossible for them to devote any official time to the undertaking. Everything depends then upon the extent to which they are willing and able to devote private time to it.

3. I have myself the completion of the Flora very much at heart, and I shall certainly do all in my power to comply with Lord Salisbury's wishes.

I am, &c.
(Signed) W. T. THISELTON-DYER.

Sir Villiers Lister, K.C.M.G.,
Foreign Office, Downing Street, S.W.

Meanwhile the publication of novelties from recent collections is being rapidly prosecuted by the German botanists. At Kew, Vol. IV. of the Flora is in active preparation. But inasmuch as it cannot go to press till the material for the whole is prepared, it has been thought desirable to publish from time to time in the pages of the *Kew Bulletin* brief diagnoses of the new species so as to secure priority for the names.

APOCYNACEÆ.

Auctore O. STAPF.

1. **Carpodinus calabaricus,** *Stapf;* frutex alte scandens, ramulis novellis dense fulvo-hirsutis, foliis ellipticis vel oblongis breviter abrupteque acuminatis supra fulvo-hirsutis mox glabratis subtus subtomentosis, nervis lateralibus 5–7 eximie camptodromis, cymis terminalibus fulvotomentosis, floribus paucis vel ad 10 bracteis plerumque 4 oblongis acuminatis suffultis, calycis lobis subliberis bracteis consimillimis, corollæ tubo gracili extus pubescente intus pilis paucis obsito lobis lineari-lanceolatis tubum æquantibus, filamentis medio tubo insertis brevissimis, antheris lanceolatis, ovario et styli basi fulvo-tomentosis, baccis oblongis, seminibus 8–12 ovoideis compressis.

Old Calabar River, *Mann*, 2242.

Folia 2½–3½ poll. longa, 1–1¾ poll. lata. *Calyx* 2 lin. longus. *Corollæ* tubus 8 lin. longus. *Bacca* 1½–1¾ poll. longa.

2. **Carpodinus Barteri,** *Stapf;* scandens cirris terminalibus vel pseudoaxillaribus gracilibus parce ramosis, ramulis novellis et inflorescentiis breviter rufo-hirsutis exceptis glabrescens, foliis late ellipticis basi cordatis rarius rotundatis obtusis vel subacutis coriaceis, nervis lateralibus 5–6 remotis eximie camptodromis, cymis axillaribus sessilibus contractis, floribus paucis vel ad 10, bracteis solitariis minutis vel nullis, calycis lobis ovatis obtusis basi connatis, corollæ tubo gracili extus rufo-pubescente intus sparse piloso, lobis lanceolatis tubo aequilongis, filamentis paulo infra faucem insertis brevissimis, antheris lanceolatis, ovario hirsuto, bacca breviter stipitata obovoidea glabrescente.

Lagos, *Barter*, 20,138, *Moloney*, *Roland;* Old Calabar River, *Mann*, 2261.

Folia 2¼–3½ poll. longa, 1½–2 poll. lata, *petiolus* 2 lin. longus. *Calyx* 1½ lin. longus. *Corollæ* tubus 4½ lin. longus. *Bacca* (an matura ?) 3½ in. longa.

The plant yields india-rubber according to *Moloney*.

3. **Carpodinus uniflorus,** *Stapf;* scandens, floribus exceptis glaber, foliis oblongo-lanceolatis basi longe cuneatis abrupte acuminatis pallide viridibus, nervis lateralibus 6–3 eximie camptodromis sub ipso margine arcuatis, floribus solitariis axillaribus subsessilibus, bracteis 4 late ovatis obtusis, calycis lobis subliberis bracteis consimillimis, corollæ tubo latiusculo extus tenuiter puberulo intus parce pubescente lobis lineari-lanceolatis tubum æquantibus, filamentis supra medium insertis brevissimis, antheris lanceolatis, ovario atque styli basi fulvo tomentellis.

Sibange Farm, Munda, Gaboon, *Soyaux*, 269.

Folia 6–8½ poll. longa, 1¾–2 poll. lata, *petiolus* 3½–5 lin. longus. *Calyx* 1¼ lin. longus. *Corollæ* tubus 6 lin. longus.

It yields a very fine india-rubber according to *Soyaux*.

4. **Carpodinus parviflorus,** *Stapf;* scandens, subglaber, foliis ellipticis vel obovatis basi leviter cordatis acuminatis coriaceis supra pallide-viridibus subtus fuscescentibus, nervis lateralibus 5–7 eximie camptodromis arcubus a margine remotis, floribus solitariis (semper ?) axillaribus, bracteis paucis minutis, calycis lobis basi in tubum brevissimum connatis acuminatis patule pilosis, corollæ tubo gracili extu.

glabro intus parce piloso, lobis lanceolatis tubum æquantibus, antheris infra faucem insertis, ovario tomentoso, stylo pubescente abrupte in stigma conicum incrassatum abeunte, bacca ovoidea apice acuminata, seminibus 6.

Sibange Farm, Munda, Gaboon, *Soyaux*, 184, 219.

Folia 3½–5 poll. longa, 1¼–2 poll. lata, *petiolus* 2½–3 lin. longus. *Calyx* 1 lin. longus. *Corollæ* tubus 3 lin. longus. *Bacca* 1½ poll. longa.

5. **Clitandra Mannii,** *Stapf;* scandens, glaber, foliis ovatis vel ellipticis abrupte acuminatis basi breviter cuneatis tenuiter coriaceis, nervis approximatis vix 1 lin. distantibus, cymis absque corollis petiolis paulo longioribus multifloris glabris minute bracteatis, calycis lobis ovatis acutis, corolla utrinque glabra tubo brevissimo lobis lineari-oblongis obtusis 2½-plo tubo longioribus, filamentis medio tubo insertis brevissimis, antheris erectis lanceolatis, ovario ovoideo, stylo brevi sensim in stigma clavatum sulcatum abeunte.

Bagroo River, *Mann*, 848.

Folia 2¼–3½ poll. longa, 1¼ poll. lata, *petiolus* 2½ lin. longus. *Calyx* ⅓ lin. longus. *Corollæ* tubus ⅓ lin., lobi vix 1 lin. longi.

6. **Clitandra Schweinfurthii,** *Stapf;* scandens, glaber, foliis ellipticis basi cuneatis abrupte acuminatis tenuiter coriaceis supra lucidis, nervis lateralibus inæqualibus validioribus 1 lin. distantibus, cymis absque corollis petiolum æquantibus paucifloris glabris minute bracteatis, calyce glabro lobis ovatis subacutis, corolla extus glabra intus subglabra tubo pallide flavo supra basin leviter ampliato lobis albis linearibus subacutis tubum duplo superantibus, ovario ovoideo stylo æquilongo, stigmate conico-capitato, fructu globoso.

Between Paongo and Gelli, Dar Fertit, *Schweinfurth*, Ser. III. 68.

Folia 2½ poll. longa, 1–1¼ poll. lata, *petiolus* 2 lin. longus. *Calyx* ⅓ lin. longus. *Corollæ* tubus 3½ lin., lobi 7 lin. longi. *Fructus* 2 poll. diametiens.

7. **Clitandra Barteri,** *Stapf;* scandens, glaber cirris terminalibus sub apice parce breviterque ramosis, foliis ellipticis vel oblongis basi breviter cuneatis abrupte vel sensim acuminatis vel obtusis tenuiter coriaceis supra sublucidis, nervis lateralibus inæqualibus validioribus vix 1 lin. distantibus, cymis absque corollis petiolis brevioribus, paucifloris glabris minute bracteatis, calycis lobis ovatis obtusis, corollæ tubo extus glabro intus valde pubescente lobis tubo paulo longioribus ovatis obtusis, antheris erectis filamentis brevissimis leviter curvatis, ovario ovoideo globoso, stylo stigmate conico breviore.

Eppah, *Barter,* Niger Exp. 3310.

Folia 3–3½ poll. longa, 1¼–1¾ poll. lata, *petiolus* 3 lin. longus. *Calyx* ⅓ lin. longus. *Corollæ* tubus 2 lin. longus.

8. **Rauwolfia macrophylla,** *Stapf;* arbor glabra, ramulis novellis 4-alatis, foliis quaternis verticillatis obovato-oblongis basi longe cuneatis in petiolum brevem sæpe indistinctum decurrentibus obtusis membranaceis, nervis lateralibus utrinque 16–24 patulis, cymis in umbellis spuriis compositis, calycis lobis breviter triangularibus acutis, corollæ lobis ovatis obtusis, stylo glabro, stigmate membrana reflexa cincto.

Upper Guinea, Ambas Bay, *Mann*, 1328.

Arbor 40–50 ped.-alta. *Folia* 6–8 poll. longa, 2½–3 poll. lata. *Pedunculus* 1½–2 poll. longus; radii primarii ¾–1½ poll., secundarii

3–5 lin., *pedicelli* ½–1 lin. longi. *Calycis* lobi ⅓–½ lin. longi. *Corollæ* tubus 1¼–2 lin., lobi ⅓ lin. longi.

9. **Rauwolfia mombasiana,** *Stapf;* frutex glaber, internodiis ramorum novellorum summis quadrangularibus, foliis quaternatis, oblongis vel oblongo-lanceolatis in petiolum attenuatis acutis vel acuminatis membranaceis, nervis lateralibus utrinque 15–18 subpatulis, cymis in umbellis spuriis compositis, pedicellis gracillimis calycis lobis ovatis acutis, corollæ lobis ovatis obtusis, carpellis liberis ovatis, stylo glabro tenui, stigmate truncato basi membrana reflexa cincto, drupa ovoidea coccinea, seminibus 1–2.

Mombasa, *Hildebrandt*, 2011, *Wakefield!*; Zanzibar (?), *Kirk*, 84; Shupanga, *Kirk*.

Folia 4–6 poll. longa, 1–2 poll. lata. *Pedunculus* 2–4 poll. longus, radii primarii ½–2 poll., secundarii 6–4 lin., *pedicelli* 3 lin. longi. *Calyx* ½–¾ lin. longus. *Corollæ* tubus 3–3½ lin., lobi ¾ lin. longi. *Drupa* 3–4 lin. longa.

10. **Rauwolfia Mannii,** *Stapf;* frutex glaber, ramulis novellis superne quadrangularibus, inferne teretibus, foliis ternatis vel quaternatis oblongis valde inæqualibus in petiolum attenuatis abrupte in acumen angustum lineare contractis membranaceis, nervis lateralibus utrinque 12–16 (in foliis longioribus) subhorizontalibus, cymis circiter 3-floris longe pedunculatis, calycis lobis lineari-lanceolatis, corollæ lobis ovatis obtusis, carpellis basi connatis ovatis, stylo tenui glabro, stigmate acuto basi membrana reflexa cincto, drupa oblique ovoidea solitaria vel 2 geminatis ad medium connatis, endocarpio crustaceo, seminibus solitariis.

Gaboon, Sierra del Crystal, *Mann*, 1720.

Folia majora 5–9 poll. longa, 2–3 poll. lata, minora 2–2½ poll. longa, ¾–1 poll. lata. *Pedunculus* 1 poll. longus; *pedicelli* ad 2 lin. longi. *Calycis* lobi 1 lin. longi. *Corollæ* tubus vix 3 lin., lobi ½ lin. longi. *Drupa* 4–5 lin. longa.

11. **Pleiocarpa bicarpellata,** *Stapf;* frutex glaber, ramulis novellis quadrangularibus foliis oblongis in petiolum brevem attenuatis obtuse acuminatis firmule membranaceis supra sublucidis, nervis lateralibus patulis subrectis 1–1½ lin. distantibus sub margine in nervum continuum collectis, cymis axillaribus sessilibus paucifloris, calycis lobis ovatis acuminatis, corollæ tubo extus glabro intus minute puberulo, lobis ovatis acutis tubo fere 2-plo brevioribus, filamentis infra faucem insertis, antheris lanceolatis basi bilobis lobis brevibus incurvis, ovario globoso-ovoideo glabro, stigmate bilobo, carpellis liberis ovulis 2 in utroque loculo dorso peltatim affixis.

Cameroon Mts. 4000 feet, *Mann*, 1,213; Sierra Leone, *Barter* (e specimine imperfecto).

Frutex 12–15 ped. altus. *Folia* 3–4 poll. longa, 1–1¼ poll. lata; *petiolus* 2 lin. longus. *Calyx* ½ lin. longus. *Corollæ* tubus 3 lin. longus.

12. **Voacanga Schweinfurthii,** *Stapf;* frutex ramis gracilibus, foliis oblanceolatis vel oblongis sensim in petiolum attenuatis vel inferioribus abrupte contractis subsessilibus acutis vel subacuminatis membranaceis glabris, cymis pseudoumbellatis 4–6-floris, pedunculis gracilibus, bracteis oblongis mox deciduis, calyce tubuloso-campanulato lobis rotundato-obovatis obtusis tubum æquantibus, corolla flava lobis tubo aequilongis obovatis abrupte breviterque acuminatis, bacca ovata.

Niamniam Country, Turu River, *Schweinfurth*, C. Afr. 3326.

Frutex 15 ped. altus. *Folia* 6–8 poll. longa, 1¾–2½ poll. lata, *petiolus* ad ⅓ poll. longus. *Pedunculus* 1½–2½ poll., *pedicelli* ½–1 poll. longi. *Calyx* 5–7 lin. longus, *Corollæ* tubus 5–7 lin., lobi ¾ poll. longi.

13. **Voacanga bracteata,** *Stapf;* frutex ramis gracilibus, foliis lanceolatis vel oblongo-lanceolatis acuminatis basi cuneatis membranaceis, petiolis tenuibus, cymis contractis corymbosis 5–9 floris, pedunculis pedicellisque gracilibus, bracteis numerosis persistentibus oblongis obtusis vel subacuminatis, calyce campanulato lobis rotundatis tubo paulo brevioribus, corollæ tubo in alabastro submaturo calyci aequilongo.

Bagroo River, *Mann*, 858 ; Old Calabar, *Thomson*, 39.

Folia 5–7 poll. longa, 1¾–2 poll. lata, *petiolus* 3–5 lin. longus. *Pedunculus* 2–2½ poll., *pedicelli* 2–4 lin. longi. *Bracteae* 5–2 lin. longæ. *Calyx* 5–4 lin. longus.

14. **Tabernamontana nitida,** *Stapf;* arbor glaberrima, ramis novellis crassitie pennæ anserinæ subteretibus, foliis oblongis basi rotundatis abrupte acuminatis tenuiter coriaceis supra lucidis, nervis lateralibus utrinque 24–30 subrectis patulis, petiolo robusto, floribus 10–15 in umbellis spuriis terminalibus pedunculo valido suffultis, calyce 5–partito campanulato segmentis late ovatis obtusissimis basi intus multiglandulosis, corolla alba tubo subgracili lobis oblongis tubum æquantibus, staminibus inclusis infra faucem insertis, stylo filiformi in stigma clavatum annulo destitutum abeunte, baccis geminatis magnis, oblongis.

Upper Guinea, Ambas Bay, *Mann*, 710.

Arbor 60–80 ped. alta. *Folia* 5½–7 poll. longa, 2–3 poll. lata, *petioli* ½ poll. longi. *Pedunculus* ½–1 in., *pedicelli* 4–6 lin. longi. *Calyx* 3 lin. longus. *Corollæ* tubus 7 lin. longus. *Baccae* 4 poll. longæ, 3 poll. latæ.

15. **Tabernæmontana brachyantha,** *Stapf;* arbor glaberrima foliis magnis ellipticis acutis basi rotundatis utrinque opacis subcoriaceis, nervis lateralibus utrinque 9–12 patulis subrectis, petiolo valido brevissimo, floribus numerosis in corymbis longe pedunculatis, calyce 5–partito late tubuloso-campanulato segmentis late oblongis basi intus multiglandulosis, corolla alba suaveolente tubo brevi lato superne ampliato extus glabro intus tomentello, lobis lineari-oblongis tubo duplo longioribus intus basin versus dense tomentellis margine undulatis, staminibus medio tubo insertis subexsertis, stigmate conico basi annulato.

Fernando Po, *Mann*, 221.

Arbor 40–50 ped. alta. *Folia* 9–16 poll. longa, 5–9 poll. lata, *petiolus* 3–5 lin. longus. *Pedunculus* 6 poll., *pedicelli* ad 4 lin. longi. *Calyx* 3 lin. longus. *Corollæ* tubus 3–4½ lin., lobi ad 9 lin. longi.

16. **Tabernæmontana pachysiphon,** *Stapf;* frutex glaber foliis magnis ovatis vel ellipticis basi subacutis utrinque opacis subcoriaceis, nervis lateralibus utrinque 13–15 subpatulis subrectis, petiolo robusto brevi, floribus paniculatis (?), panicula bracteata, pedunculo crasso, calyce 5–partito late campanulato segmentis late oblongis basi intus multiglandulosis, corolla alba fragrante tubo lato e basi fere ad medium ampliato superne sensim attenuato extus glabro intus dense piloso, lobis oblongis in margine undulatis tubo brevioribus, staminibus infra medium insertis

faucem attingentibus, stigmate longiuscule cylindrico sulcato basi annulato.

Lower Niger, Onitsha, *Barter*, 1320.

Frutex 10 ped. altus. *Folia* ad 15 poll. longa, ad 8½ poll. lata, *petiolus* ad 1 poll. longus. *Pedicelli* 4–5 lin. longi. *Calyx* 4 lin. longus. *Corollæ* tubus 9 lin. longus, ad 4 lin. latus, lobi 8 lin. longi.

17. **Tabernæmontana angolensis**, *Stapf;* ramis novellis penna anserina crassioribus, foliis oblongo-ellipticis basi acutis brevissime acuminatis utrinque opacis subcoriaceis, nervis lateralibus utrinque 9–12, obliquis subrectis, petiolo robusto, floribus corymbose-paniculatis, inflorescentia bracteata, pedunculo robusto, calyce 5-partito late campanulato segmentis late oblongis vel obovatis basi intus multiglandulosis, corollæ tubo latiusculo basi ad tertiam partem ampliato tunc attenuato sub fauce iterum dilatato extus glabro intus dense piloso, lobis oblongis, staminibus in tertia parte infima insertis faucem haud attingentibus, stigmate breviter cylindrico sulcato basi annulato, carpellis liberis.

Angola, *Welwitsch*, 5989.

Folia 7–8 poll. longa, 3–3½ poll. lata, *petiolus* 5–6 lin. longus. *Pedunculus* 5 poll., *pedicelli* ad 1 poll. longi. *Calyx* 4 lin. longus. *Corollæ* tubus 1 poll. longus, ad 3½ lin. latus, lobi 12–14 lin. longi.

18. **Tabernæmontana contorta**, *Stapf;* arbor glaberrima, ramulis novellis penna anserina crassioribus, foliis ellipticis vel sub-obovatis obtusis basi rotundatis et brevissime contractis utrinque opacis crassiusculis pallidis costa inferne carinata valida, nervis lateralibus utrinque 9–12 subpatulis subrectis, petiolo brevi latiusculo, floribus magnis subcorymbosis, pedunculo pro ratione florum gracili, calyce 5-partito late campanulato lobis rotundato-oblongis basi intus multiglandulosis glandulis brevissimis, corolla alba tubo basi valde contorto angulato supra basin leviter dilatato ab hinc cylindrico necnon sub fauce sensim ampliato, extus glabro intus dense tomentello, lobis obovato-oblongis tubum æquantibus vel eo paulo longioribus, staminibus in parte quarta infima insertis medium tubum attingentibus, stigmate cylindrico sulcato basi paulo dilatato subannulato.

Ambas Bay, *Mann*, 703.

Arbor 30–40 ped. alta. *Folia* 7–11 poll. longa, 4–6 poll. lata, *petiolus* 4–6 lin. longus; *Pedunculus* 4 poll., *pedicelli* ad ¾ poll. longi. *Calyx* 4 lin. longus. *Corollæ* tubus 2¼ poll. longus.

19. **Tabernæmontana stenosiphon**, *Stapf;* foliis obovato-oblongis oblongisve utrinque acutiusculis opacis membranaceis, nervis lateralibus utrinque 12–14 tenuibus subpatulis subrectis, petiolo tenui brevi, floribus laxe corymbosis(?), pedunculo subgracili, calyce 5-partito lobis obovatis obtusis ima basi intus multiglandulosis, corollæ tubo tenui contorto vix dilatato extus glabro intus dense piloso lobis anguste oblongis tubo multo longioribus superne basin versus tomentellis, staminibus in tertia parte infima insertis fere faucem attingentibus, antheris angustissimis.

St. Thomas, comm. *Henriquez.*

Folia 6–8 poll. longa, 2¼–3½ poll. lata, *petiolus* ½ poll. longus. *Pedunculus* 1½ poll., *pedicelli* ½ poll. longi. *Calyx* 2 lin. longus. *Corollæ* tubus 9–10 lin. longus, vix ultra 1 lin. latus, lobi 1½ poll. longi, ad 7 lin. lati.

20. **Tabernæmontana durissima,** *Stapf;* arbor glaberrima ligno durissimo, ramis novellis crassitie pennæ anserinæ, foliis obovatis vel oblongis basi attenuatis vel subrotundis, obtusis vel subapiculatis utrinque opacis subcoriaceis, nervis lateralibus utrinque 6–12 obliquis subrectis petiolo brevi vel brevissimo, floribus corymbosis, pedunculo pro ratione florum subgracili, pedicellis crassiusculis, calyce late campanulato 5-partito lobis latissime ovatis basi intus multiglandulosis, corollæ odoræ tubo vix contorto angusto supra basin paulo dilatato extus glabro intus sub staminum insertione et in fauce lineis pilosis notato cæterum glabro, lobis oblongo-lanceolatis, staminibus in sexta parte infima insertis tertiam partem tubi attingentibus, stylo brevi gracili, stigmate cylindrico sulcato longiusculo basi annulato.

Gaboon, Munda, Sibange farm, *Soyaux*, Pl. Occ. Afr. 172.

Arbor 50–70 ped. alta. *Folia* 6–9 poll. longa, 3–4 poll. lata, *petiolus* ad ½ poll. longus. *Pedunculus*, 4 poll., *pedicelli* ad ½ poll. longi. *Calyx*, 2½ lin. longus. *Corollæ* tubus 1¾ poll. longus, ad 2 lin. latus, lobi 2 poll. longi.

Two rather incomplete specimens from Old Calabar (*Thomson*, 73) and from the Lower Congo (*Chr. Smith*) may belong also to this species.

21. **Tabernæmontana eglandulosa,** *Stapf;* frutex scandens glaberrimus, ramis teretibus internodiis longis fistulosis, foliis oblongis basi attenuatis abrupte acuminatis opacis membranaceis, petiolo tenui, pedunculis axillaribus breviusculis, floribus in corymbis vel umbellis spuriis densis, calyce late campanulato 5-partito lobis obovatis vel oblongis intus eglandulosis, corolla alba fragrantissima tubo basi paululo dilatato cæterum cylindrico tenui lobis lanceolatis vel linearibus undulatis tubo paulo brevioribus, staminibus paulo supra basin insertis vix quartam partem tubi attingentibus, stylo brevi vel brevissimo, stigmate longiuscule cylindrico basi annulato, drupis aurantiacis ovatis geminatis.

Lower Niger, Eppah, *Barter*, 3306; Yoruba, *Millson*, 12; Old Calabar River, *Mann*, 2253; Fernando Po, *Mann*, 239; Gaboon, Kongui, John River, *Mann*, 1794; Munda, Sibange farm, *Soyaux* 183, 239.

Folia, 5–6 poll., rarius ad 8 poll. longa, 2–3 poll. lata, *petiolus*, ½–¾ poll. longus. *Pedunculus*, ½–1 poll. longus, *pedicelli* ad 3 lin. longi. *Calyx*, 1½–3½ lin. longus. *Corollæ* tubus 1¼–2¼ poll. longus, lobi 1¼–2 poll. longi. *Drupa* 1¾ poll. longa.

The size of the calyx and the corolla vary considerably; but I am not able to distinguish varieties upon these differences. The habit, the absence of glands in the calyx, the narrow corolla lobes, and the very short style are very characteristic.

22. **Tabernæmontana elegans,** *Stapf;* frutex glaberrimus, ramis floriferis penna corvina vix crassioribus, foliis anguste oblongis obtusis vel acutis basi acutatis opacis subtus pallidioribus crassiusculis, nervis lateralibus utrinque 16–22 subhorizontalibus fere ad marginem rectis, floribus parvis numerosis in inflorescentiis subcorymbiformibus pedunculatis bracteatis, bracteis scariosis parvis citissime deciduis, calyce breviter campanulato 5-partito lobis late ovatis obtusis basi intus glande solitario bifido ornatis, corolla luteo-alba tubo brevi cylindrico extus glabro intus imprimis in fauce tomentello, lobis oblongis tubo longioribus, staminibus paulo supra basin insertis inclusis, stylo brevi tenui,

stigmate cylindrico basi annulato, drupis geminatis oblique ovatis recurvis apiculatis.

Lower Zambesi, between Senna and Lupata, and at Shupanga, *Kirk;* Delagoa Bay, *Monteiro*, 55.

Frutex, 8–10 ped. alta. *Folia*, 4–5 poll. longa, 16–20 lin. lata, *petiolus*, 5–7 lin. longus. *Pedunculus*, 1 poll. longus, *pedicelli* ad 6 lin. longi. *Calyx*, 1–1¼ lin. longus. *Corollæ* tubus 3 lin., lobi 4½ lin. longi.

Very like *T. persicifolia, Jacq.*, in habit, but differing in the larger oblong leaves, looser inflorescences, smaller flowers and particularly in the very short style.

GENTIANEÆ.

Auctore J. G. Baker.

23. **Belmontia zambesiaca**, *Baker;* caulibus gracilibus erectis simplicibus, foliis sessilibus trijugis lanceolatis vel oblongo-lanceolatis, floribus solitariis longe pedunculatis, sepalis ovato-lanceolatis dorso anguste alatis, corollæ tubo calyci æquilongo, lobis obovato-cuneatis, staminibus supra medium tubi insertis.

Zambesia, in the valley of the Leshumo, *Holub.*

Folia 4–6 lin. longa. *Sepala* 4 lin. longa. *Corollæ* lobi 2 lin. longi.

24. **Belmontia pumila**, *Baker;* caulibus gracilibus erectis 1–4 floris infra nodos alatis, foliis 4-jugis ovatis oblongis subacutis, pedicellis brevissimis, sepalis ovato-lanceolatis dorso anguste alatis, corollæ tubo calyce sesquilongiori, lobis perparvis obovatis, staminibus supra medium tubi insertis.

Swamps at Nupe, near the mouth of the Niger, *Barter.*

Folia 3–4 lin. longa. *Sepala* 1½ lin. longa.

25. **Belmontia platyptera**, *Baker;* caulibus gracilibus erectis 4-alatis 1–4-floris, foliis paucijugis ovatis acutis basi cuneatis, pedicellis brevissimis, sepalis ovatis dorso late alatis, corollæ tubo calyce paulo longiori, lobis 5 obovatis perparvis, staminibus supra medium tubi insertis.

Angola, province of Huilla, *Welwitsch*, 1524.

Folia 3–4 lin. longa. *Sepala* 3 lin. longa.

26. **Chironia laxiflora**, *Baker;* caulibus gracilibus elongatis 4-angulatis, foliis remotis ovatis acutis, cymis in paniculam laxam dispositis, pedicellis elongatis, calyce tubo brevi lobis lanceolatis acuminatis, corollæ tubo calyce breviori, limbo rubello lobis lanceolatis, antheris spiraliter fortis, fructu calyci æquilongo.

Manganja Hills, Zambesia, alt. 3000 ped., *Meller, Kirk.*

Folia 6–9 lin. longa. *Calyx* 3 lin. longus. *Corollæ* lobi 4 lin. longi. *Antheræ* 2 lin. longæ.

27. **Voyria primuloides**, *Baker;* caulibus flexuosis unifloris, foliis rudimentariis carnosis perparvis adpressis, calycis tubo campanulato lobis

ovato-cuspidatis, corollæ tubo cylindrico calyce 2–3- plo longiori, limbi lobis ovatis, antheris supra medium tubi insertis.

Gaboon country, at Sibange Farm, *Soyaux*, 166.

Caulis 2–3 poll. longus. *Calyx* 4 lin. longus. *Corollæ* tubus 8–9 lin. longus, limbus 6–9 lin. diam.

28. **Voyria platypetala,** *Baker;* caulibus flexuosis unifloris, foliis rudimentariis scariosis perparvis adpressis, calycibus lobis setaceis tubo multo brevioribus, corollæ tubo cylindrico, lobis orbicularibus basi cuneatis, antheris supra medium tubi insertis.

Banks of the River Nun, *Mann.*

Caulis 2–3-pollicaris. *Calyx* 3 lin. longus. *Corollæ* tubus 9 lin. longus, limbus 4 lin. diam.

29. **Faroa Buchanani,** *Baker;* annua, glabra, caulibus erectis, foliis remotis sessilibus linearibus, capitulis 5–15 in paniculam dispositis, pedicellis brevissimis, calycis tubo campanulato lobis ovatis, corolla calyce duplo longiori, lobis oblongis, staminibus inclusis.

Nyassa-land, *Buchanan* (1135 of 1891 set).

Caulis pedalis. *Folia* inferiora 1½–2 poll. longa. *Calyx* 1½ lin. longus. *Corolla* 3 lin. longa.

30. **Faroa graveolens,** *Baker;* caulibus erectis superne ramosis, foliis superioribus linearibus inferioribus lanceolatis, cymis terminalibus congestis, pedicellis brevissimis, calycis lobis obovatis, corolla lilacina lobis brevissimis, staminibus corollæ æquilongis.

Uganda and Uzongora, *Wilson.* A decoction is used in malarial ague. The plant smells like Asafœtida.

Caulis 6–9 poll. longus. *Folia* 1–1½ poll. longa. *Calyx* 1 lin. longus. *Corolla* 2 lin. longa.

31. **Faroa pusilla,** *Baker;* caulibus brevissimis, foliis oblongis membranaceis basilaribus rosulatis, cymis capitatis 2–3 pedicellis brevibus, calycis lobis ovatis tubo longioribus, corollæ lobis perparvis albidis, fructu calyce æquilongo.

Sandy soil on the edge of swamps, Nupe, Lower Niger, *Barter.*

Caulis 1–1½ pollicaris. *Folia* pollicaria. *Calyx* ¾ lin. longus.

32. **Schultesia senegalensis,** *Baker;* annua, caulibus erectis simplicibus acute angulatis, foliis 4–6-jugis sessilibus ovato-lanceolatis, floribus paucis axillaribus, calyce scarioso late quadrialato, corollæ tubo calyci æquilongo, lobis obovatis.

Senegal, *Heudelot*, 551; south bank of the River Gambia, *Brown-Lester.*

Caulis 3–6-pollicaris. *Folia* 6–12 lin. longa. *Calyx* 4 lin. longus. *Corollæ* lobi 3 lin. longi.

BORAGINEÆ.

Auctore J. G. BAKER.

33. **Cordia aurantiaca,** *Baker;* arborea, ramulis pubescentibus, foliis oblongis acutis subcoriaceis facie glabris dorso obscure pubescentibus,

cymis in paniculas terminales aggregatis, ramulis velutinis, calyce florifero oblongo velutino 10-sulcato, dentibus minutis, corollæ tubo calyci æquilongo, limbo luteo lobis orbicularibus, stylis e tubo exsertis.

Fernando Po, *Barter*, *Mann* ; Gaboon, *Soyaux* ; Congo, *C. Smith* ; Angola, Golungo Alto, *Welwitsch* 5430, 5466.

Folia 4–6 poll. longa, 2–3 poll. lata. *Calyx* floriferus 5–6 lin. longus. *Corollæ* limbus 12–15 lin. diam.

34. **Cordia chrysocarpa,** *Baker* ; arborea, foliis ovatis longe petiolatis coriaceis basi rotundatis vel cordatis facie scabris dorso pubescentibus, cymis paucifloris, calyce fructifero campanulato haud sulcato, fructu oblongo acuto splendide luteo.

Angola, Golungo Alto, *Welwitsch* 5461.

Folia 6–8 poll. longa, petiolo 2–4 pollicari. *Calyx* fructiferus 1 poll. diam. *Fructus* siccus 15–18 lin. longus.

35. **Cordia Heudelotii,** *Baker* ; ramulis glabris, foliis oblongis acutis distincte petiolatis e basi 3–5 nerviis facie scabris dorso glabris, cymis amplis laxis terminalibus, calyce florifero infundibulari glabro dentibus 5 parvis ovatis, corollæ lobis oblongis, fructu ovoideo.

Senegambia, *Heudelot* ; Lower Niger in forests at Yoruba, *Barter*.

Folia 3–4 poll. longa, petiolo 12–18 lin. longo. *Calyx* floriferus 3 lin. longus. *Corollæ* limbus 3 lin. diam. *Fructus* 6 lin. longus.

36. **Cordia platythyrsa,** *Baker* ; arborea, ramulis pubescentibus, foliis oblongis acutis distincte petiolatis facie lævibus glabris dorso pubescentibus, cymis in paniculam amplam aggregatis, calyce florifero infundibulari tomentoso haud sulcato lobis 5 ovatis, corollæ lobis oblongis.

Banks of the Bagroo River, *Mann*.

Folia 4–5 poll. longa, 2–3 poll. lata. *Calyx* floriferus 2 lin. longus. *Corollæ* limbus 3 lin. diam.

37. **Cordia populifolia,** *Baker* ; ramulis apice tomentosis, foliis suborbicularibus distincte petiolatis e basi triplinervis facie viridibus glabris dorso tomento pallide brunneo præditis, cymis in paniculam amplam aggregatis, calyce infundibulari tomentoso lobis 4 ovatis, corollæ tubo calyce breviori, lobis oblongis.

Banks of the Bagroo River, *Mann*.

Folia 5–6 poll. longa. *Calyx* floriferus 2 lin. longus.

38. **Cordia Milleni,** *Baker* ; arborea, foliis cordato-orbicularibus longe petiolatis dorso subtiliter pubescentibus, cymis in paniculam amplam aggregatis, calyce dense tomentoso tubo oblongo leviter sulcato lobis ovatis, corollæ tubo calyce paulo longiori lobis oblongis, staminibus e tubo exsertis.

Inland forests of Lagos, *Millen*. Native name, *Omon*.

Folia 6–8 poll. longa et lata. *Calyx* floriferus 3 lin. longus. *Corollæ* limbus 6 lin. diam.

39. **Cordia longipes,** *Baker* ; ramulis pilosis, foliis longe petiolatis suborbicularibus e basi triplinerviis facie scabris dorso pilosis, cymis terminalibus valde compositis, calyce tubo oblongo dense tomentoso lobis 4 late ovatis, corollæ tubo cylindrico calyce duplo longiori, limbi lobis oblongis.

Angola, *Welwitsch*, 5428.

Folia 8–10 poll. longa et lata, petiolis 2–4 poll. longis. *Calyx* 3 lin. ongus. *Corollæ* limbus 4 lin. diam.

40. **Cordia Kirkii**, *Baker ;* ramulis pubescentibus, foliis ovatis breviter petiolatis ovatis repandis penninerviis utrinque dense pubescentibus, cymis densis terminalibus, calyce florifero haud sulcato dense tomentoso dentibus parvis ovatis, corollæ tubo calyci æquilongo, fructu oblongo cuspidato.

Lower Zambesi at Tette, *Kirk*.

Folia 4–5 poll. longa. *Calyx* floriferus 3 lin. longus. *Corollæ* limbus 6 lin. diam. *Fructus* 12 lin. longus.

41. **Cordia pilosissima**, *Baker ;* ramulis dense pilosis, foliis breviter petiolatis suborbicularibus utrinque dense pilosis e basi triplinervis, cymis subsessilibus valde compositis, calycis tubo infundibulari dense piloso haud sulcato lobis parvis ovatis, corollæ tubo calyce paulo longiori, lobis oblongis.

Angola, *Welwitsch*, 4784.

Folia matura haud visa. *Calyx* 3 lin. longus. *Corollæ* limbus 5–6 lin. diam.

42. **Cordia obovata**, *Baker ;* arborea, ramulis pubescentibus, foliis breviter petiolatis obovato-cuneatis obtusis facie scabris dorso pubescentibus, cymis compositis, calyce florifero infundibulari glabro lobis parvis ovatis, corollæ lobis oblongis.

C. senegalensis, Hochst. in Schimp. Pl. Abyss. no. 2180, non Juss.

Abyssinia, *Schimper*, 2180 (leaves crenate) ; 192 (leaves entire).

Folia 2–3 poll. longa. *Calyx* floriferus 2–2½ lin. longus. *Corollæ* limbus 3 lin. diam.

43. **Cordia somaliensis**, *Baker ;* arborea, ramulis albo-pubescentibus, foliis breviter petiolatis oblanceolato-oblongis obtusis basi cuneatis facie scabris dorso dense pubesentibus, cymis densis terminalibus valde compositis, calyce florifero infundibulari parce piloso haud sulcato lobis 4–5 ovatis, ovario ovoideo, styli apice furcato.

Coast of Somali-land, near Kisinga, *Kirk*.

Folia 2–2½ poll. longa, 9–12 lin. lata. *Calyx* floriferus 2 lin. longus.

44. **Ehretia acutifolia**, *Baker ;* arborea, ramulis glabris, foliis distincte petiolatis ovatis acutis membranaceis glabris, cymis in paniculam densam terminalem dispositis, pedicellis brevibus, calyce glabro campanulato lobis obtusis, corollæ tubo calyci æquilongo, lobis obtusis.

Ambas Bay, *Mann*.

Folia 4–6 poll. longa, petiolo sesqui-pollicari. *Calyx* 1½ lin. longus. *Corollæ* tubus 3 lin. diam.

45. **Ehretia divaricata**, *Baker ;* arborea, ramulis tenuiter pilosis, foliis breviter petiolatis oblongis subobtusis glabris, cymis laxissimis amplis, pedicellis brevissimis, calyce glabro tubo brevi lobis ovatis, corollæ tubo brevi lobis oblongis, staminibus lobis corollæ æquilongis.

Zambesia, on Ischizadruaro Mountains, *Kirk*.

Folia 3–4 poll. longa. *Calgx* 1 lin. longus. *Corollæ* lobi 2 lin. longi.

46. **Ehretia macrophylla,** *Baker;* arborea, ramulis glabris, foliis distincte petiolatis oblongis acutis basi cuneatis, cymis parvis densis terminalibus, calyce glabro profunde 5–dentato, corollæ tubo calyce duplo longiori, lobis oblongis tubo brevioribus, fructu depresso-globoso.

Dar Salam, *Kirk.*

Folia 6–8 poll. longa, petiolo pollicari. *Calyx* 1 lin. longus. *Fructus* 2 lin. diam.

47. **Ehretia angolensis,** *Baker;* fruticosa, ramulis glabris, foliis breviter petiolatis oblongis acutis subcoriaceis glabris, cymis terminalibus valde compositis, pedicellis brevissimis, calyce glabro lobis ovatis, corollæ tubo infundibulari, lobis tubo brevioribus, fructu globoso.

Angola, *Monteiro, Welwitsch,* 5444, 5463.

Folia 3–4 poll. longa, petiolo 3–6 lin. *Calyx* 1 lin. longus. *Corolla* 2½ lin. longa. *Fructus* 2 lin. diam.

48. **Trichodesma grandifolium,** *Baker;* caulibus herbaceis setis albis armatis, foliis oppositis ovatis scabris superioribus subsessilibus basi late rotundatis inferioribus breviter petiolatis, cymis laxis multifloris, pedicellis hispidis, calycis lobis ovatis cuspidatis strigosis, corollæ lobis suborbicularibus, antheris parvis breviter cristatis.

Somali-land, at Adda Galla and Zafarag, *James* and *Thrupp.*

Folia 5–6 poll. longa. *Calyx* floriferus 6 lin. longus. *Corollæ* limbus 10–12 lin. diam.

49. **Trichodesma Medusa,** *Baker;* caulibus fruticosis dense hispidis, foliis alternis lanceolatis crassis scabris sessilibus, cymis densis copiosis terminalibus, pedicellis brevibus hispidissimis, calyce hispidissimo lobis lanceolatis, corollæ tubo calyce breviori, lobis linearibus acuminatis, antheris longe cristatis.

Angola, *Johnston, Welwitsch,* 5302.

Folia inferiora 1½–2 poll. longa. *Calyx* floriferus 6 lin. longus. *Corollæ* lobi 6 lin. longi. *Antheræ* 6 lin. longæ.

50. **Trichodesma pauciflorum,** *Baker;* fruticosa, ramosissima, ramulis strigosis, foliis caulinis breviter petiolatis ovatis basi rotundatis hispidis et albo-tuberculatis, cymis paucifloris, pedicellis brevibus strigosis, calyce strigoso lobis lanceolatis basi haud cordatis, corollæ tubo brevi, lobis late ovatis minute cuspidatis, antheris breviter cristatis.

Hamish Island, near the mouth of the Red Sea, *Slade.*

Folia superiora 12–18 lin. longa. *Calyx* floriferus 6 lin. longus. *Corolla* 6 lin. longa. *Antheræ* 3 lin. longæ.

51. **Cynoglossum Johnstoni,** *Baker;* caulibus ramosissimis dense breviter hispidis, foliis sparse tuberculato-hispidis superioribus sessilibus lanceolatis, inferioribus oblongo-lanceolatis petiolatis, cymis elongatis laxis multifloris, pedicellis brevissimis, calycis lobis tubo longioribus, corollæ limbo cœruleo lobis latis, nuculis minimis dorso dense muricatis.

Kilimanjaro, alt. 6,000 ped., *Johnston.*

Cymi demum semipedales. *Calyx* floriferus 1½ lin. longus. *Corollæ* limbus 2 lin. diam.

52. **Myosotis æquinoctialis,** *Baker;* annua, caulibus dense pilosis, foliis caulinis sessilibus lanceolatis vel oblongo-lanceolatis, cymis basi bracteatis, pedicellis brevissimis ascendentibus, calyce dense hirsuto

lobis lineari-oblongis tubo æquilongis, corollæ tubo calyci æquilongo, limbo cœruleo, nuculis nitidis atris.

Kilimanjaro, alt. 13,000–14,000 ped., *Johnston.*

Cymi demum 1½–2 poll. longi. *Calyx* demum 2 lin. longus. *Corollæ* limbus 1 lin. diam.

53. **Lobostemon cryptocephalum,** *Baker;* perennis, caulibus simplicibus hirsutis, foliis sessilibus lineari-oblongis hispidis, cymis dense capitatis foliis supremis suboccultis, calyce hispido lobis lanceolatis, corollæ tubo calyce sesquilongiori, lobis suborbicularibus parum inæqualibus, staminibus in tubo inclusis.

Fwambo, Lake Tanyanika, *Carson.*

Folia centralia majora subuncialia. *Calyx* 3 lin. longus. *Corollæ* limbus 2½–3 lin. diam.

54. **Heliotropium phyllosepalum,** *Baker;* annua, caulibus ascendentibus molliter pilosis, foliis obovatis obtusis petiolatis, cymis scorpioideis densis multifloris ebracteatis, calyce dense piloso tubo brevissimo lobis ovatis inæqualibus, corollæ tubo calyci æquilongo, limbo lobis parvis orbicularibus, stylo brevissimo, stigmatis cristâ conica, nuculis calyce brevioribus.

Banks of the River Shiré at Moramballa, *Lawrence Scott.*

Folia 1½–2 poll. longa. *Cymi* demum 2 poll. longi. *Calyx* 1½ lin. longus.

This belongs to the group of *H. europæum.*

BIGNONIACEÆ.

Auctore J. G. Baker.

55. **Tecoma shirensis,** *Baker;* fruticosa, glabra, foliis longe petiòlatis imparipinnatis, foliolis 9–13 oblongis acutis integris, racemis brevibus simplicibus, pedicellis pubescentibus, bracteis parvis, calyce glabro tubo oblongo, dentibus parvis deltoideis, corolla tubo subcylindrico curvato calyce triplo longiori, limbo tubo duplo breviori, genitalibus longe exsertus.

Shiré Highlands, *Buchanan.*

Folia semipedalia, foliolis superioribus 1½–2 poll. longis. *Calyx* 4 lin. longus.

56. **Dolichandrone platycalyx,** *Baker;* arborea, foliis imparipinnatis, foliolis 3-jugis oblongis acutis glabris, floribus in paniculis densis axillaribus dispositis, pedicellis dense pubescentibus, calyce spathaceo pubescente apice obtuso mucronato, corolla lutea calyce 2-3-plo longiori, tubo supra basin campanulato, limbo magno lobis orbicularibus.

Uganda, *Wilson.* Native name, *Lusambia.*

Folia 6–9 poll. longa, foliolis 3–4 poll. longis. *Calyx* uncialis *Corollæ* tubo 2–2½ pollicaris, limbo 18–24 lin. lato.

57. **Dolichandrone Smithii,** *Baker;* ramulis glabris, foliolis oblongis glabris acutis vel obtusis, floribus in paniculam laxam amplam dispositis, ramis patulis apice cymosis, pedicellis brevibus, calyce parvo glabro campanulato, corolla calyce 6–8-plo longiori, tubo extus pubescente, limbo patulo, genitalibus in tubo inclusis.

Kilimanjaro, *Lieut. C. Smith.*

Foliola superiora 2 poll. longa. *Calyx* 3–4 lin. longus. *Corolla* 2 poll. longa, tubi ore 6–9 lin. diam.

58. **Dolichandrone hirsuta,** *Baker;* ramulis dense pubescentibus, foliolis 2–3-jugis oblongis obtusis utrinque dense pubescentibus, floribus in paniculas axillares paucifloras dispositis, pedicellis gracilibus dense pubescentibus, calyce parvo apice rotundato mucronato, corolla calyce triplo longiori, tubo supra basin infundibulari, limbo patulo.

Banks of Lower Zambesi, at Tette, *Kirk.*

Foliola immatura 1–1½ poll. longa. *Calyx* 4 lin. longus. *Corolla* pollicaris, tubo ore 3–4 lin. diam.

59. **Dolichandrone Hildebrandtii,** *Baker;* fruticosa, foliolis 2–3-jugis oblongis acutis glabris, floribus in paniculas amplas axillares dispositis, pedicellis pubescentibus, calyce glabro apice obtuso mucronato, corolla lutea calyce triplo longiori, tubo supra basin infundibulari, limbo patulo lobis obovatis.

Kitui, in Ukamba, *Hildebrandt* 2732.

Foliola 2–3 poll. longa. *Calyx* 8–9 lin. longus. *Corolla* 2 poll. longa, tubo ore 4–6 lin. diam., lobis 5–6 lin. longis.

60. **Dolichandrone latifolia,** *Baker;* foliolis 5–7 oblongis acuminatis glabris, floribus in paniculas paucifloras dispositis, pedicellis glabris, calyce apice mucronato recurvato, corolla calyce triplo longiori, tubo supra basin infundibulari, limbo patulo lobis obovatis.

Nyika Country, *Wakefield.*

Foliola 3–6 poll. longa. *Calyx* 6 lin. longus. *Corolla* 15–18 lin. longa, tubo ore 4 lin. diam. lobis 6 lin. longis.

61. **Dolichandrone obtusifolia,** *Baker;* fruticosa vel arborea, foliolis 7–9 oblongis obtusis utrinque pubescentibus, floribus in paniculam densam thyrsoideam dispositis, ramulis pedicellisque pubescentibus, calyce magno pubescente apice rotundato mucronato, corolla lutea calyce duplo longiori, tubo supra basin campanulato, fructu magno arcuato tomentoso.

Shupanga, Moramballa and Bagamoyo, *Kirk;* Shiré Highlands, *Buchanan.*

Foliola 3–4 poll. longa. *Calyx* 9–12 lin. longus. *Fructus* bipedalis. *Semina* (ala inclusa) 18 lin. diam.

62. **Dolichandrone stenocarpa,** *Baker;* arborea, foliolis trijugis oblongis glabris, floribus in paniculas laxas terminales dispositis, pedicellis pubescentibus, calyce glabro apice recurvato, corolla calyce 2–3-plo longiori, limbo patulo lobis obovatis, fructu elongato angusto valvis flexilibus medio carinatis.

Muentera stenocarpa, Seem. in Journ. Bot. 1869 p. 329, t. 36, ex parte.

Golungo Alto, Angola, *Welwitsch,* 482, 483.

Foliola 2–4 poll. longa. *Calyx* 4–6 lin. longus. *Fructus* pedalis et ultra. *Semina* (ala inclusa) 9–12 lin. diam.

63. **Heterophragma longipes,** *Baker;* foliolis 5–6-jugis oblongis acuminatis glabris, floribus 4–8 in cym laterali axillaria dispositis, pedicellis longissimis, calyce glabro late campanulato lobis orbicularibus,

corolla calyce triplo longiori lobis orbicularibus, staminibus e tubo longe exsertis.

Lake Chidia, Rovuma, Zambesia, *Kirk; Wakefield.*

Foliola 3 poll. longa. *Pedicelli* 2–3 poll. longi. *Corolla* 3 poll. longa, lobis 10–12 lin. diam.

64. **Rhigozum zambesiacum,** *Baker;* ramulis virgatis glabris, foliis minutis 3–5-foliolatis rachi alato, foliolis obovatis, floribus 1–3-nis, pedicellis brevibus glabris, calyce campanulato glabro lobis tubo brevioribus, corolla calyce 3-plo longiori, fructu oblongo haud rostrato.

Valley of the Zambesi, near Tette, *Kirk.*

Calyx 2 lin. longus. *Corolla* 6–8 lin. longa. *Fructus* 1½–2 poll. longus, 4 lin. diam.

CCCLIX.—MISCELLANEOUS NOTES.

Visitors during the year 1893.—The number of persons who visited the Royal Gardens during the year 1893 shows an increase of 379,229 on the attendance for the preceding year, and is the largest as yet recorded, except for 1890, when it reached 1,839,966. The total number of visitors for the past year was 1,733,386, as compared with 1,354,157 in 1892. The detailed numbers for 1893 are given below:—

Month.	Numbers.	Month.	Numbers.
January	16,405	Brought forward	939,766
February	33,899	July	197,944
March	135,821	August	329,410
April	284,811	September	145,593
May	284,586	October	73,650
June	184,244	November	27,595
		December	19,428
Carried forward	939,766		
		Total	1,733,386

The total attendance on Sundays was 676,894; on week days 1,056,492. The two totals used formerly almost to balance; the present disparity is in part accounted for by bank holidays. The greatest monthly attendance (August) was 329,410; the smallest monthly attendance (January) was 16,405. The greatest Sunday attendance (on June 18) was 29,891; the smallest (on December 10) was 318. The greatest week day attendance (on May 22) was 100,737; the smallest (on January 17) was 110.

The death of the veteran botanist, collector, and traveller, Richard Spruce, took place on December 29th, at the age of 76. In a notice which appeared in the *Times* it is stated that he was sent to South America on behalf of the Royal Gardens at Kew in 1849. This is an error; yet he did so much for Kew that some account of his labours deserves recording here. In early life he was a tutor at York, and during that period he studied the native flora with great success, and was a frequent contributor to the *Phytologist* and other periodicals; his first paper appearing in 1841. In 1845 he visited the Pyrenees, and botanised there, devoting himself specially to the *Musci* and *Hepaticæ*, an account of which he published. The thoroughness of his work soon gained him the acquaintance and friendship of the principal botanists of this country; and this eventually led to his travels across South America, from the Atlantic to the Pacific, through the Amazon region. Sir William Hooker was mainly instrumental in promoting this journey, not only by means of his wide-spread influence, but also by advancing money. Spruce had, of course, many other supporters, notably the Earl of Carlisle, Mr. R. Brown, and Mr. G. Bentham; the last named gentleman undertaking the laborious task of arranging and distributing the collections as they arrived in England. Spruce went to America in 1849 and returned in 1864; and the results were such as have hardly been equalled by any other traveller, except Humboldt, in that country. It was estimated by Mr. Bentham that his plants alone numbered 7,000 species; but this was only a part of his work, all of which was carried out in the most methodical and accurate manner. The first set of his dried plants is at Kew, and the Museum was no less enriched than the Herbarium; the Garden to a less extent. He never published a connected narrative of his travels, but many of his copious letters appeared in Hooker's *Journal of Botany*, where also may be found particulars of some of the more interesting Museum objects. During the latter portion of his sojourn in South America he rendered most important services in connexion with introduction of the chinchona into India; concerning which he wrote an elaborate report, which has proved invaluable as a guide to cultivation. He returned in a very shattered state of health, and although he has survived so many years, it has been as an invalid. Indeed, previous to his going to America, he was so delicate that Sir William Hooker, at the last moment, tried to dissuade him from the enterprise. In spite of continued bad health he has accomplished an immense amount of valuable work since his return, especially on the *Hepaticæ*, and notably in his *Hepaticæ Amazonicæ et Andinæ*, which forms the fifteenth volume of the Edinburgh Botanical Society's *Transactions*. His last contribution to our knowledge of this group of plants was read before the Linnean Society of London just one week before his death.

Dry Rot.—A remarkable instance of the growth of dry rot has recently been discovered in the Armoury of the Tower of London. In November a communication was made to the Royal Gardens from the Horse Guards, War Office, to the effect that on repairing one of the wooden horses in the Armoury, believed to be more than 100 years old, a mass of fungus was found in the interior. It was cut out with the portion of wood to which it was attached and sent to Kew, when it proved to be a large and characteristic specimen of the ordinary dry-rot fungus (*Merulius lacrymans*, Jacq.). This fungus, as is well known, is very destructive to timber in close and ill-ventilated situations. The singular circumstance in this case is that it appears to have been arrested in its growth and killed and desiccated before it had produced the smallest fragment of fructification.

Handbook of the Flora of Ceylon.—The rich flora of the island of Ceylon found an early historian in Hermann (1717), followed by Linnæus, who worked out Hermann's materials afresh in his "*Flora Zeylanica*," 1747. This was before the publication of his binominal system of nomenclature; and it was not until 1824 that there was another substantial addition to the botanical literature of the island, when Moon's Catalogue appeared, "for the use of the Singhalese." Then came Thwaites's *Enumeratio Plantarum Zeylaniæ*, containing descriptions of a large number of previously undescribed species. This was completed in 1864. Dr. H. Trimen succeeded Dr. Thwaites as Director of the Royal Botanic Gardens, Ceylon, in 1880, and he is now issuing, at the cost of the Ceylon Government, under the above title, the results of his unremitting studies of the flora since his appointment. This is called a "Handbook," but it is really a very elaborate work; the first volume including only the natural orders, *Ranunculaceæ* to *Anacardiaceæ*. At this rate the vascular plants will occupy five volumes, to say nothing of the plates, of which twenty-five, of quarto size, accompany the first volume. Dr. Trimen's work is of a most thorough character, written wholly in English, and on a most excellent plan. It embodies a complete re-elaboration of Hermann's original Herbarium, the foundation of Ceylonese botany. Dr. Trimen has further cleared up, with all the critical insight of a skilled and practised botanist, a number of species which were either imperfectly understood or badly described, or even, perhaps, erroneously included in the Flora. And he has added many new species, the result of his prolonged explorations of every part of the island.

Materials for a Flora of the Malay Peninsula.—Dr. G. King, the Superintendent of the Royal Botanic Gardens, Calcutta, has just completed the first volume of this work, reprinted from the *Journal of the Asiatic Society of Bengal* (1889–93). The original pagination is retained, but he has added a continuous pagination together with a complete index. The specially noteworthy fact in connexion with this work is the enormous number of new trees described, many of them, doubtless, of great commercial value. The last part, recently received, contains the *Dipterocarpeæ*, of which there are 61 species referred to 11 genera; and 40 of the species were previously undescribed.

Viticulture in Malaga.—The following account is taken from Mr. Consul Finn's report:—

"In my former reports I have laid stress on the magnificent climate of this place. The Algeciras-Bobadilla Line of Railway now brings Malaga within such easy distance of England by land or water. Many foreigners come here for their health, and it deserves to be better known by our countrymen.

"There is no doubt that great damage has been done in this province by the phylloxera to the vines, and by kindred diseases among the orange and lemon trees; but after many conversations with landed proprietors and farmers of all sorts, I have come to the conclusion that much of the decadence in the fruit culture in this province is due to old age in the plants and the inability of small or very conservative farmers either to spend the necessary money for replanting their orchards, or else to properly work and manure the soil. Many thousands of acres have become unproductive, which, with careful management, could be made as fruitful as ever they were; and it seems to me that many a young Englishman, if he only knew of it, would be glad to turn his steps hitherwards to a delightful country, within five days of home, instead of going off to Florida or Canada; of trying his fortune in a province where, in case of illness, he is always within reach of a town, whence he can draw his supplies; and then, in case of wishing to return home, the most that can cost him is some 6*l.* to 8*l.* for his ticket by steamer. Many and many a small farmer (Spanish) has deserted his farm and emigrated to South America, because, his farm having once been attacked by the phylloxera, he had not the few pounds necessary for replanting the vineyards, and because he had not sufficient knowledge or initiative to try whether other trees or crops would not grow in their stead. These farms, with buildings on them, can now be purchased for a song by those who know how to set about it.

"The following interesting notes have been given me by a friend, and will, I trust, produce some result:—

"The slopes to the north and north-east of Malaga, once planted with vines, have of late years been devasted by the phylloxera, and are only used now as a pasture ground for goats. Besides vines, the olive, fig, pomegranate, and other fruit trees grow with great luxuriance. This land is divided into properties ranging from 50 fanegas to 100 fanegas.* Each property has a house, provided with all necessary appliances, of a primitive character, for pressing and storing wine, stables &c., combined with dwelling for the owner. Nearly all these farms belong to people living in or near Malaga. There are vegetable gardens and orchards, formed in terraces, attached to the houses, in which lemon, orange, pomegranate, and other fruit trees are reared. Water is not very plentiful, however, though there is, generally speaking, more than sufficient for the requirements of the household and for watering the orchards in summer time, and more can be obtained by boring.

"The land itself is not very rich, as usually happens with hilly land, but both the character of the country and the composition of the earth (oxide of iron predominating) make it well suited for vine culture.

"In its present condition the land can be bought very cheap, and may be valued at about 50 pesetas to 75 pesetas the fanega (17*s.* to 55*s.* per 1½ acres) for the land. The fruit trees are valued separately, and the house and other buildings are taken to represent one-third of the total of the other values added together; so that, taking a farm of 50 fanegas, the average price may be estimated as follows:—

"Fifty fanegas at 60 pesetas, average, 3,000 pesetas; fruit trees, orchards, &c., say 5,000 pesetas; house and outbuildings (one-third of 8,000 pesetas), 2,667 pesetas; total. 10,667 pesetas. Or, say 400*l.* for a farm of 75 acres, with buildings, and partly stocked.

"Labour is cheap and plentiful, wages ranging from 1½ pesetas to 2 pesetas (1 peseta=about 9*d.*) a day, according to the season. This includes food. The meals cost 65 c. to 75 c. (100 c.=1 peseta) per head per diem, according to season and price. When working on the land the men are divided into gangs of eight or ten in each, each one having an overseer, and if there be several gangs a chief overseer is placed over them all.

"Taxes on land in an unproductive state are very small, and according to present legislation, a farm which has been freshly planted with vines or fig trees is free from taxation for 10 years as regards the new plantation. The transfer duty is 3 per cent.; a piece of land sold, within my knowledge, for 1,500 pesetas, had 88 pesetas law expenses, including transfer duty. Law expenses are in proportion lower for larger purchases. Natural manure is scarce and very difficult to obtain in the mountains, as owing to the want of good roads transport is dear; but chemical manure, which can be bought here at 6 c. per stock, and lasting for 3 years, can be recommended. The cost of planting an "obrada" of 1,000 stocks, including the price of the American vine, is about 75 pesetas, and for working the ground about 25 pesetas for each successive year. In the third year after planting the riparia (American vine) it is grafted at a cost of about 25 pesetas per 1,000 stocks, and the stocks now begin to yield, but only a small crop. The yield, after five years (reckoned from the grafting) may be estimated as 5 hectolitres (13·755 bushels) per 1,000 stocks; after 10 years at 8 hectolitres (or, say 22 bushels) without manuring. With manuring the yield can be raised to double the amount.

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* 1 fanega = 1·6374 acres.

"The fertility of the land, of course, depends upon its fruit-bearing qualities, *i.e.*, chemical composition, and land should not, therefore, be bought unless the analysis as to phosphates, chalk, potassium, &c. is satisfactory." (F.O. 1893. Annual Series. No. 1,282.)

Gum Tragacanth.—The principal source of this product is Asia Minor, though it has long been known to have been yielded by a large area in Persia; of late the latter source seems to have been largely developed.

EXTRACT from the Report for the year 1892 on the Trade of Baghdad and Bussorah, p. 2:—

"In gum tragacanth, which comes both from Persia and Sulimania, a larger trade was done than has ever taken place in past years. The supply was large, and everything brought to market was eagerly bought up, owing to the high prices which were ruling in the London market. This is an article which some years ago was almost unknown here, and now it is one of the principal exports of the country, and promises to become of more importance year by year." (F.O. Annual Series, 1894, No. 1,320.)

ROYAL GARDENS, KEW.

BULLETIN
OF
MISCELLANEOUS INFORMATION.

No. 86.] FEBRUARY. [1894.

CCCLX.—HORTICULTURE AND ARBORICULTURE IN THE UNITED STATES.

The British Commission for the Columbian Exposition at Chicago expressed the wish that a member of the Kew staff would undertake the office of judge in horticulture. The First Commissioner of Her Majesty's Works and Public Buildings accordingly approved of the delegation of Mr. G. Nicholson, A.L.S., Curator of the Royal Gardens, for the task.

Mr. Nicholson left England on June 18 in order to arrive at Chicago on July 1, the date appointed for the commencement of his duties. This having, however, been postponed, Mr. Nicholson was able to devote some time to visits to Washington, St. Louis, Roan Mountain, &c., and other places where either horticultural enterprise or the woody vegetation of the United States could be advantageously studied. He was thus enabled to collect much valuable information and secure the aid for the Royal Gardens of many new correspondents. In these important results of his tour he secured the kindest help from Professor Sargent, the distinguished American botanist and Director of the Arnold Arboretum of Harvard University at Jamaica Plain, Massachusetts.

Mr. Nicholson has drawn up the following notes of the results of his visit, more especially with regard to the trees and shrubs cultivated in the United States. The result will be, without doubt, their more complete representation in the Arboretum of the Royal Gardens.

The notes, which cover a period of about two months, are arranged in chronological order.

HOLM LEA, NEAR BROOKLINE, MASS.

Holm Lea is the residence of Professor C. S. Sargent, the Director of the Arnold Arboretum. The extensive grounds (about 150 acres) surrounding it are remarkable for the beautiful landscape effects which have been produced by the judicious removal of aboriginal forest, the equally careful planting of exotic trees and shrubs, and an entire absence of tender (or bedding) plants for ornament. No flower garden proper occupies any portion of the extensive lawns, but herbaceous plants, many of them native N. American species, supply colour among the shrubberies. The fine specimens of Japanese flowering shrubs have been selected for definite spots, and arranged, after careful study, for artistic effect. Some of the most beautiful pictures, however, have been produced by native shrubs and trees which are to be found in the immediate neighbourhood. My first visit to Holm Lea was on June 28th, and, except where otherwise stated, the plants mentioned below were noted about that date. As a rule, deciduous flowering trees and shrubs grow with infinitely greater freedom here than in Britain; so great is the difference, indeed, that persons only acquainted with them in England sometimes find it difficult to recognise species with which they are perfectly familiar in this country. *Syringa japonica*, a Japanese species, is apparently a finer tree or shrub in the North-Eastern United States than in its native habitats; at Holm Lea the finest specimen was about 18 feet high, and bore immense panicles of small creamy white flowers, which contrasted finely with the large dark green leaves. In this country there are no plants so large as the one above mentioned, and it is yet too early to form a definite judgment of the value of the species as an ornament to our gardens.

Berberis Thunbergi is a very handsome low shrub, and is remarkable for the beauty of its fruits, which are produced in great profusion, and for the splendid colour—rich orange-red or crimson—assumed by the decaying leaves in autum.

Lonicera tatarica and its varieties at the end of June are conspicuous on account of their innumerable small fruits, yellow or bright red. Judging from the quantity of berries, the bushes must have presented a fine sight when in flower.

Lonicera ruprechtiana, an Asiatic species, is, however, the most handsome of the bush honeysuckles when laden with scarlet fruit; the flowers are yellowish, and not particularly showy.

Hypericum aureum, a native of the South-Eastern United States, was discovered more than a century ago by the younger Bartram, but was practically unknown in cultivation until distributed from the Arnold Arboretum a few years ago. The largest specimen I have ever seen is at Holm Lea; it measures about 5 feet in height, and is about 6 feet through. The orange-yellow flowers (with golden coloured stamens) measure from 1½ to 2 inches across; there are few dwarf shrubs better worth a place in the garden.

Cornus florida, one of the most beautiful of deciduous flowering trees or shrubs, is just on the northern limit of its range at Boston; it grows here very freely, flowers profusely, and a huge mass at Holm Lea was covered with young fruit, which later on becomes scarlet, and is very showy. The decaying leaves in autumn assume vivid colours. In Britain we do not get sufficient summer heat to ripen the wood and produce flowers, although the species is hardy. The western representative of the genus, *C. Nuttallii*, a still finer species, refuses altogether to grow at Boston; it does, however, in Britain, and it is hoped that it will flower; if so, it will prove of great value as an ornamental tree.

Cladrastis amurensis, from Amurland, a fine specimen about 25 feet high, the largest I have ever seen, was just coming into flower. This species is far inferior in beauty to the only other species of the genus (*C. tinctoria*), one of the rarest trees of the North American forests, as it only grows in a few isolated localities from Middle Kentucky and

Tennessee to the extreme south-western portions of N. Carolina. A portrait of a very fine tree of this latter (in flower) in Professor Sargent's grounds is given in "Garden and Forest," (vol. i., 1888, p 92). The tree in question has been planted about 40 years, is about 40 feet high, and has a spread of upwards of 60 feet.

Catalpa speciosa at the time of my visit was in full flower. The inflorescence is more lax than that of *C. bignonioides*, the individual flowers are much larger, and they are produced from 10 to 14 days earlier. It has quite a different distribution from *C. bignonioides*, being confined to the Mississippi Valley, and, as far as experiments have hitherto proved, it appears to be one of the most promising trees for planting on the almost treeless western prairies, notwithstanding the intense heat (often for long periods without rain), and, moreover, growing rapidly. This species is worthy the attention of landscape gardeners and others in this country.

Ligustrum Ibota.—The form of this species I have seen cultivated in Britain is a somewhat stiff-growing by no means striking bush, with erect panicles. The one grown in quantity for ornament by Professor Sargent is a graceful, very floriferous shrub, with pendulous panicles, and is decidedly one of the most desirable members of the genus; it only requires to be seen in character to be fully appreciated by all growers of trees and shrubs.

Hydrangea vestita, var. *pubescens*, a Chinese plant, is quite hardy here, and at the end of June was in full flower; it is a handsome bush, worthy of extended cultivation.

Acers.—The North-eastern American species, *A. dasycarpum* and *A. rubrum*, do well here, and form fine trees, the former being one of the commonest trees for street planting. The sugar maple (*A. saccharinum*) also does well, and makes a fine object, either in streets or as a single specimens, on lawns; one perfect specimen at Holm Lea, branched to the ground, was about 60 feet high, and worthy in every way of the fine position in which it had been placed. The European *A. platanoides*, the common Norway maple, also does well, grows fast, attains a large size, and possesses apparently the same immunity from insect attacks as the sugar maple. As a rule, the common sycamore (*A. Pseudo-platanus*) is an unsatisfactory tree in the Eastern United States. The Japanese species thrive admirably, but are generally short-lived; the various forms of *A. palmatum* are especially conspicuous; a cut leaved purple form measured 10 feet through, and was a splendid bush. *A. cissifolium* was also represented by a huge bush, larger and finer than any seen in Japan by Professor Sargent during his travels in that country; the young shoots are purplish tinted, and the mature leaves turn a splendid orange-crimson in autumn. The Amurland *A. Ginnala*, too, thrives better here than I have ever seen it elsewhere (one tree was 30 feet in height). It is the only maple known to Professor Sargent which has fragrant flowers; in autumn, too, the colouration of the decaying leaves is remarkably brilliant.

Syringa oblata here is the first lilac to flower; the leaves are leathery, and are never attacked by a mildew which often greatly disfigures all the varieties of *S. vulgaris* in the United States. This species should be utilised by hybridisers to obtain a race with the leaves of *S. oblata* and the large flowers of *S. vulgaris*. In Britain its early flowering propensities are rather against it, as the flowers are frequently injured by late frosts. *S. pubescens* is looked upon by Professor Sargent as one of the best shrubs which have been introduced within the last 20 years; the flowers are small individually, but are produced in such profusion as to make the bushes appear as if clothed with rose-coloured mist. *S. pekinensis*, a white-flowered species, is a slender tree-like shrub, with flexuous branches covered with a yellow-brown bark. *S. japonica* has been already mentioned at the commencement of these notes.

Viburnums.—V. dilatatum appears to grow much more vigorously than in Britain, and is perfectly hardy; it is, perhaps, the finest of ornamental autumn-fruiting plants, being covered with scarlet berries. *V. tomentosum*, another Japanese species, perhaps better known in English gardens as *V. plicatum*, is one of the best of all white-flowering shrubs. *V. Opulus*, var. *americanum*, is employed with good effect; it is useful on account of its white flowers, followed by scarlet fruit, and for the fine colour of the foliage in autumn.

Rhododendrons.—None of the seedlings containing much "ponticum" blood will stand the rigorous winters of Boston and its neighbourhood. Professor Sargent has, however, a wonderful series of "Catawbiense" seedlings which thrive, but apparently not so well as in the cooler, moister climate of Britain.

The Ghent azaleas do well, and so do the seedlings and hybrids of the Chinese and Japanese *A. mollis. R. myrtifolium* (of Loddiges), a compact growing plant of garden origin, stands the climate well.

Conifers.—Pre-eminent amongst conifers in the North-Eastern United States are the white pine, *Pinus Strobus*, and the hemlock spruce, *Tsuga canadensis.* These two are the most beautiful as well as by far the most useful from a landscape point of view, and they are employed with great effect at Holm Lea. A weeping form of the latter was taken from the woods some score years ago by Professor Sargent; it now forms a striking mass about a yard high and about four yards through. The Norway spruce is used as a hedge and kept cut in; under these conditions it is attractive. As an ornamental tree it has been largely planted in many places in North-Eastern America, and is hardy and grows rapidly, but it soon becomes unsightly and cannot be depended on for more than 20 or 30 years; the same remarks apply to the Scotch fir (*Pinus sylvestris*).

Taxus cuspidata, var. *brevifolia*, a short-leaved form of the Japanese species, is perfectly hardy at Boston, whilst the European *Taxus baccata* cannot withstand the severity of the winters. As a dwarf-growing bush it seems worthy of the attention of planters in this country. The blue spruce (*Picea pungens*) makes a fine object at Holm Lea, one specimen being about 25 feet in height and of a beautiful silvery blue colour. *Abies concolor*, about 30 feet high, was perfect in form; the Colorado form of this species, though not so tall as the one just mentioned, was remarkable for the beauty of its colour. The form of the Douglas fir (*Pseudotsuga Douglasi*), from Colorado, is also "bluer" than the type from the Pacific Coast, and is quite hardy at Boston and elsewhere, where the more western plant cannot withstand the winter cold. This Colorado plant should be tried in England in places where the common Douglas fir does not thrive.

Abies sibirica, a fine young tree 25 feet high, was bearing cones. At Kew this begins to grow too early, and is always more or less injured by spring frosts; it is the first to begin growth at Boston, but apparently Boston gardeners are not tried by late spring frosts. Amongst other noteworthy conifers was a fine specimen of *Pinus bungeana*, bearing cones; it was a handsome plant, upwards of 12 feet high, and with a spread of branches at the base of about six feet. *Prunus pendula*, at Holm Lea and elsewhere, is a remarkably handsome tree. Professor

Sargent declares it to be one of the floral treasures of the world, and writes in "Garden and Forest" that it is one of the loveliest in flower and the most pleasing and graceful in habit of all the plants which have been transferred from the gardens of Japan to those of this country. When in flower (the blossoms precede the leaves) the tree presents the aspect of a pink fountain. Another Japanese species, *P. tomentosa*, thrives well, and bears abundant crops of fruit.

Rhus typhina, the common stag's horn sumach, a species found wild everywhere near Boston, is used with excellent effect near ornamental water, its large, handsome, pinnate leaves forming a fine mass of deep green. This clump, as well as many others, is "connected with the ground" by means of an irregular band of *R. aromatica*, a low-growing species which makes a natural and artistic outline. The young shoots of the latter are purplish tinted, and the decaying leaves of both colour well in the late autumn.

Wild Gardening.—The end of a moraine drift, covered with wild trees from 150 to 200 years old, has given opportunities for wild gardening on an extensive scale. Hickories, oaks, hop-hornbeams, &c., form the bulk of the native tree vegetation, and underneath native shrubs and herbaceous plants abound. Among these are *Sambucus canadensis*, in flower at the end of June, *Cornus alternifolia*, *Rhus typhina*, with *Vitis Labrusca* and *Smilax herbacea* climbing at will over them. *Trillium grandiflorum* is thoroughly at home, and has been planted in large quantities. Professor Sargent informs me that a beautiful contrast is furnished by *Narcissus poeticus* and *Scilla campanulata* planted together; they flower at the same time. A host of other plants, too numerous to mention, keep up the succession of flowers until late autumn, when the asters and golden rods appear.

Bulbous and Tuberous Summer-flowering Plants.—In the well-kept greenhouses, remarkable for the excellent cultivation displayed, were a large collection of fine gloxinias and begonias. As a rule, the latter are difficult to grow in the United States, and are rarely seen in really good condition. In beds in the open ground *Acidanthera bicolor*, a beautiful irid from the mountains of Abyssinia and the Zambesi country, was conspicuous, with its spikes of slender tubed, white, purple throated flowers. Outside it requires the same treatment as *Gladiolus brenchleyensis*, but it makes an excellent pot plant, and only needs to be better known to become a favourite in gardens. Gladioli are raised in large quantities from seed, and the indifferent or badly-coloured varieties ruthlessly destroyed as they came into flower. Both *Acidanthera* and gladioli were in full flower August 18th. *Lycoris squamigera*, a Japanese amaryllid, introduced to cultivation under the name of *Amaryllis Hallii*, was one of the most striking plants in the Rockery. In June there was a fine mass of leaves about 2 feet long; on August 18th these had already ripened off and disappeared, and a dozen inflorescences had taken their place; the scapes were 2½ to 3 feet in height, and bore on an average six flowers.

The space at my disposal is too limited to mention all the good plants noted in and around the greenhouses. Standard wistarias, kept pinched in and grown specially for flowering in tubs, were, however, particularly noticeable. Indian azaleas of all sizes were being turned out of pots and planted in the open at the end of June; on August 18th the growth had been made and the buds were well set. At the end of September the plants would be repotted and placed in the houses for next spring's flowering. The roof of one house was covered with a splendid specimen of *Quisqualis indica*, which seemed to revel in full sunlight; large quantities of its flowers, white changing to red, were cut weekly for indoor decoration.

ARNOLD ARBORETUM.

Before entering into details respecting this unique establishment, it may be as well to give a short summary of its history. The following extract is from an article by Mrs. M. C. Robbins in the April number of "The Century" for the current year:—"About the year 1870, " Mr. James Arnold, of New Bedford, a native of Providence, Rhode " Island, an excellent merchant of Quaker origin, a man of marked " individuality of character, and of large wealth, ... left a " bequest of 100,000 dollars to three trustees, to be employed as seemed " good to them, for the improvement of agriculture or horticulture. " His friend and trustee, Mr. George B. Emerson, whose classical " report on the trees and shrubs of Massachusetts is well known, " recommended that this money should be devoted to founding an " Arboretum, to be called by Arnold's name. . . . . " Accordingly it was agreed that if the Harvard corporation would set " aside 125 acres for the purpose, the sum should be allowed to " accumulate until it amounted to 150,000 dollars, and then be used " for the purpose above named. Harvard University owned at that " time a tract of land of some 300 acres in Jamaica Plain. . . . . " This land was partly peat-bog and meadow and partly scantily " wooded upland, where were a few fine trees, a stretch of pasture, and " a noble grove of hemlocks crowning a hill. One hundred and " twenty-five acres of this land the University consented to set apart " for this purpose, and by an agreement between the municipality of " Boston and the corporation of Harvard University, the city has " undertaken to build and care for the roads of the Arboretum, and to " police it, in exchange for the privilege of including it in its park " system, so that the public may have free access to the grounds."

Professor C. S. Sargent, whose labours in the cause of forest preservation, and whose work in dendrology, are well known to all students of those subjects throughout the world, became Director, and the work of organising the Arboretum has proceeded rapidly under his able administration. "Through the liberality of Mr. H. H. Hunnewell, " one of the most generous patrons of horticulture in the United " States, a museum has been erected which contains the photographs, " the herbarium, and the scientific books collected by Professor Sargent " at great cost, through a long series of years, and given by him to the " institution—a princely gift, invaluable to students, who can learn " here in connexion with the living museum all that there is to be " known about trees, which nowhere can be taught more completely." The upper floor of this building contains the Herbarium and Library, the latter in all probability the best working dendrological library in existence; the lower is devoted to the purposes of a museum, in which will be arranged the specimens of timber, &c. Here will be kept for reference an extraordinary series of specimens, *i.e.*, those which furnished the data for the phenomenal sets of tables which appeared in the Tenth Census Report on the Forests of North America (exclusive of Mexico) published in 1884. The tables in question contain the specific gravity, the per-centage of ash, relative approximate fuel value, co-efficient of elasticity, modulus of rupture, resistance to longitudinal pressure, resistance to indentation, and weight of a cubic foot in pounds, of very nearly every species of tree in the United States. It will also contain specimens corresponding to those collected by Professor Sargent, and presented by Mr. Morris K. Jesup to the American Museum of Natural History in New York—the most complete collection of the timbers of any great continent ever brought together.

From the Report of the Arnold Arboretum for 1890-1 we learn that the experiment, which proved highly successful, was begun during that year of furnishing the public with popular instruction about trees and shrubs, Mr. J. G. Jack, an assistant in the Arboretum, being appointed university lecturer on arboriculture for that purpose.

The area of the Arboretum is 168 acres, some 40 acres having been obtained by the City of Boston in addition to the original land. The ground was laid out by Mr. F. L. Olmsted, and, with the exception of a tract of low-lying swamp, which requires draining, the whole is in working order. The trees are planted in families in botanical sequence, on a definite plan. It is believed that more than sufficient space has been allowed for the possible full growth of every tree, native or exotic which is hardy in the neighbourhood of Boston, and no supplementary species, other than those expected to reach maturity, will be planted in the permanent collections. The ground which is, or will be, occupied by permanent trees has been prepared in the most thorough and careful manner. The contract executed between the President and Fellows of Harvard College and the City of Boston provides that the Arboretum shall be maintained where it now is for a thousand years, and there is good reason to hope, therefore, that many of the trees now planted will be allowed to live out the full term of their existence. Trees have never been planted with better promise of undisturbed old age. In the report for 1885-6 we are informed that none of the trees in the type groups have been planted in pits less than ten feet square, and all trees planted singly and intended to develop into specimens are planted in pits 25 feet square. Rock, gravel, and sandy soil have been removed from all pits to a uniform depth of three feet and replaced by a compost of loam and peat. The soil, as far as practicable, has been deepened and enriched over the whole surface planted. As the permanent specimen of no large growing tree is placed at a less distance than a hundred feet from the group of individuals of the same species selected to show variation in character and habit, it will be possible to study the species as a single specimen, and to note its value in a mass under as nearly natural conditions as it is possible to secure in any artificial wood.

On a carefully formed map the position of every permanent tree is marked, and reference to the card catalogue will give a complete history of every plant, so that the student will know when the seed was planted (and whence it came), or the cutting was rooted; or, if it is grafted, where the stock and scion came from, together with an account of its size or habit every year, and any peculiar circumstance connected with any stage of its life.

The natural advantages of the situation, with its beautifully undulating ground, are made the most of, and fine landscape effects are produced. The margins of the roadways are planted thickly with native and exotic shrubs, and amongst these large numbers of goldenrods, asters, &c., all of which look as if they had themselves chosen their quarters and did not owe their positions to the forethought of the planters. Near the Birch collection a huge mass of *Betula pumila* forms the principal feature; more plants of this species—which only grows a few feet high—are to be seen here than are to be found in cultivation in all other botanical establishments combined. At the time of my visit, the end of June, the Dyer's Greenweed, *Genista tinctoria*, an European plant introduced into North America, where in some districts it has now taken possession of thousands of acres of dry land, made a brave show with its yellow flowers. Some of the earlier goldenrods, *Solidago canadensis*, &c., were also fine, and *Rosa humilis*, a red flowering, dwarf-growing bush, was conspicuous. *Berberis Thunbergi*, various species of *Rhus*, *Myrica cerifera*, *Comptonia asplenifolia*, dwarf willows, dogwoods, viburnums, &c., with *Clematis* and *Vitis* and other climbers growing at will over their neighbours, formed a tangle which produced perfectly natural and very beautiful effects. The knife is freely used in the neighbourhood of the trees which are intended to develop; in the meantime the undergrowth is very attractive, and it keeps the ground cool and moist round them. One of the most striking as well as beautiful features of the Arboretum is Hemlock Mount, a steep rocky hillside, the north side of which is clothed with fine hemlock spruces from two to three hundred years old. Two fine illustrations of this part of the grounds appear in "The Century" for April last. The table-land at the top of the hill just mentioned is covered with various native oaks and other trees self-sown, and affords a first-rate object lesson in practical forestry. The trees are of three different ages and sizes, large ones which could be used for timber, a second growth to immediately take the place of the older ones when removed, and a third self-sown series which are ready to spring into the second rank. The axe is used to prevent one tree from damaging its neighbour, and the ground is carpeted with *Vaccinium pennsylvanicum*, and other native shrubs, as well as herbaceous plants, a number of which are cultivated in English gardens.

The large trees on the lower ground have been rejuvenated by pruning, and it is surprising to find what a change has been wrought in a few years by hard cutting-in of the branches, top-dressing of the surface soil, and by the removal of old worn-out trees which were too thick to allow sufficient light and air to reach the ground.

In the Hemlock wood I noticed growing wild along the side of a brook the spikenard, *Aralia racemosa*, a stately herbaceous plant, well known for its aromatic large roots, the skunk cabbage (*Symplocarpus fœtidus*), the lady fern, the Indian turnip (*Arisæma triphyllum*), *Baptisia tinctoria*, *Aster cordifolia*, and a host of other species which are cultivated for ornament in British gardens. Higher up the wood grew the bracken (*Pteris aquilina*). The American form of this widely distributed fern differs a good deal from the British one in its darker green, more leathery, less-cut fronds. *Maianthemum bifolium*, *Smilacina racemosa*, *Desmodium canadense*, and *Hypoxis erecta*, a pretty little amaryllid with grass-like leaves and yellow flowers, were also noted. *Rubus occidentalis*, a bramble conspicuous by reason of its stems, which appear as if whitewashed, is also native here.

The systematic collection of shrubs is planted in long beds with walks between, and occupies a considerable area. It is exceedingly rich in species and varieties, and includes every woody plant in cultivation in the United States which is hardy in the neighbourhood of Boston. In the nursery attached to the Arboretum is a very rich series of Japanese plants, the result of an extended journey through Japan last year by Professor Sargent. The seeds of about 300 species were collected by Professor Sargent on this occasion, a large proportion of which are new to cultivation.

In this nursery too have been raised by Mr. Jackson Dawson, a thoroughly good cultivator and expert propagator, some interesting and beautiful hybrids between widely different roses. One series had for parents the Japanese rose, *R. multiflora*, and the well-known old garden rose, "General Jacqueminot." Another set, perhaps destined to form a new race, is derived from *R. wichuraiana*, a prostrate Japanese rose with dark green glossy leaves and white flowers, first introduced to cultivation through the Arnold Arboretum.

No account of the Arnold Arboretum would be complete without mention of the "Silva of North America," the most important contribution of the present century to dendrological literature; this work is written by Professor Sargent in the building already mentioned, where too the artist attached to the establishment, Mr. C. E. Faxon, prepares his beautiful illustrations.

THE JESUP COLLECTION OF WOODS IN THE AMERICAN MUSEUM OF NATURAL HISTORY IN NEW YORK.

This collection, as already stated, is a remarkable one; and it is within bounds to say that the forest wealth of no other country is anywhere displayed so completely as that of America in this Museum. It is the outgrowth of an investigation of the forest wealth of North America commenced many years ago by Professor Sargent, the results of which which were published in vol. ix. of the Reports of the "Tenth Census." The catalogue of this collection, drawn up by Professor Sargent, is a very useful publication, as it gives the geographical distribution of each species, and its physical properties, &c. Large characteristic trunk specimens are exhibited, with few exceptions, in large cabinets, arranged in the sequence of their botanical relationship. "These specimens are " cut in such a way as to display the bark, and cross and longitudinal " sections of the wood, both polished and in its natural condition. " They are supplemented, in the case of trees of commercial importance, " by carefully selected planks or burls, which often show better than " logs the true industrial value of the wood." They are about five feet high, each labelled with the popular and the scientific name, and the physical properties given. A map of the United States, with the geographical distribution of the tree, shown by its area in a wild state being coloured red, accompanies each specimen. On swing cases life-size water-coloured drawings of many of the species, by Mrs. C. S. Sargent, are already in position.

RAILWAY GARDENING.

Anyone interested in railway gardening should visit the different stations of the Boston and Albany line. Probably nowhere else in the world has the same intelligent care been expended on the laying out and general keep up of the grounds on each side of the tracks near some of the stations. These grounds have been laid out by one of the ablest landscape gardeners in the world, Dr. Frederick Law Olmsted, and the buildings themselves were built by one of the best American architects, the late H. H. Richardson. Within a short distance from Boston are Auburndale and Chestnut Hill, two stations particularly worth study. A plan of the former, as well as a view of the station building and part of the grounds, are given in "Garden and Forest," vol. ii, March 13, 1889; those of the latter in vol. ii., April 3, 1889. One striking characteristic of all the stations on the Boston and Albany road is the entire absence of "bedding" plants.

A nursery has been established by the Company, in which large numbers of native as well as exotic shrubs are propagated (in order to clothe the banks of their suburban lines). This, as well as the horticultural affairs of the Corporation, are under the management of Mr. E. L. Richardson. The grounds are all laid out with neatness and simplicity, and are easy and inexpensive to maintain.

At the time of my visit a bank of a native rose (*Rosa humilis*) was clothed with flowers, and a more beautiful sight it would be difficult to imagine. Bulbous plants and perennials which require little care are allowed to grow amongst the shrubs.

The boundary fences were hidden with masses of shrubs and climbers; a few fine specimens of trees occupy positions on the fine lawns, and *Ampelopsis Veitchi* clothes the walls of the building, round which Forsythias, *Berberis Thunbergi*, and other ornamental shrubs form a charming fringe.

A competent judge has remarked:—"It is not too much to say that "these stations of the Boston and Albany railroad, taking buildings "and grounds together, are the best of their class in the world." It is believed that the Company has found them a good business investment.

WELLESLEY, THE RESIDENCE OF MR. H. H. HUNNEWELL.

"The whole estate consists of two hundred acres. About forty acres, originally a flat, sandy, arid plain in 1851, was more or less covered with a tangled growth of dwarf pitch pine, scrub oak, and birch, all of which were cut down and ploughed up."

The Pinetum contains by far the most interesting collection of coniferous trees cultivated in America. A few of the more remarkable are *Picea pungens* (laden with cones at the time of my visit), a fine example of a blue form of *P. alba*, others of *Abies concolor*, beautiful specimens with bluish leaves, *A. brachyphylla*, *A. Veitchii*, *A. cilicica*, *Picea ajanensis*, *P. polita*, *P. orientalis*, *Thuja Standishii*, 15 feet high, &c. Mr. Hunnewell considers *P. ajanensis* as one of the most promising of all conifers. The Japanese *Taxus cuspidata brevifolia* does well here, and is as hardy as any native tree. One of the glories of Wellesley is a fine tree of *Magnolia macrophylla*, which one would hardly have expected to prove hardy so far north; this has the largest flowers of any North American tree, the stately leaves are white beneath, sometimes attaining three feet or more in length, and a blossom measured 14 inches across; in colour this was white, with a large purple blotch at the base of the inner petals. A bank of *Kalmia latifolia* was a magnificent mass of flowers; the late Dr. Asa Gray used to regard this species as the most beautiful of all flowering plants. *Rhododendron catawbiense* and its progeny are largely grown at Wellesley; *R. ponticum*, and seedlings derived from it not being able to withstand the severe winters. Two rhododendrons of garden origin, viz., *R. myrtifolium* (not the *myrtifolium* of Schott and Kotschy, a near ally of *R. ferrugineum*) and *R. Wilsoni*, thrive well.

The Japanese maples do well, and some of them (*Acer japonicum*, for example) are in late autumn amongst the most brilliantly coloured of all trees or shrubs; they are later in donning their autumnal garb than the American species. *Cornus Kousa*, perhaps better known under the name of *Benthamia japonica*, was still in flower at the time of my visit. *Magnolia hypoleuca* was in fruit, and must have been fine a short time before: this species has not yet produced flowers in Britain; it is a noble foliage plant. *Catalpa speciosa*, already described in the notes of Professor Sargent's garden, was in full flower.

In a bog garden the Mocassin flower, *Cypripedium spectabile*, was thriving finely. A large mass of it had produced a considerable number of double-flowered stems. Near the house was a fine specimen of *Magnolia acuminata*, 60 feet high, which had been planted quite small in 1853. A large tree of the weeping form of our European beech was also a conspicuous object. *Clematis paniculata*, a Japanese species nearly allied to the S. European *C. Flammula*, is a rapid grower, flowers most abundantly, and is one of the finest hardy climbers for this part of the world.

Here I first saw tropical water lilies cultivated in the open air. *Nelumbium speciosum* was grown in a deep unheated tanks, but the Nymphæa tank had a hot water pipe in the bottom; among them were *N. Sturtevanti*, *N. dentata*, *N. devoniensis*, and *N. zanzibarensis*. A large number of tropical and tender plants are either plunged or planted out of doors during the summer and housed in winter. Among the tender shrubs was a fine pyramid, six feet high, of *Ligustrum coriaceum*, the best specimen I had ever seen.

From Boston to Washington.

On the morning of July 4th I left Boston for Washington. Immediately the first named town was left behind, the hedges and borders of woods near the railway were gay with the flowers of *Sambucus canadensis*. Our British chicory (*Cichorium Intybus*) grew vigorously in bare spots along the railway, and varied in colour from turquoise-blue to pink and rarely white. Other introduced weeds, the common Ox-eye Daisy (*Chrysanthemum Leucanthemum*), and Milfoil (*Achillea Millefolium*) whitened the banks in many places; these with red and white clover I subsequently tracked for many hundreds of miles; the former, indeed, was only lost sight of in the cotton-growing districts of the Southern States. *Nuphar advena*, the American representative of our yellow water-lily, was abundant in ponds. In the woods, especially in clearings, the Ostrich-Fern (*Struthiopteris germanica*) grew in profusion. The most striking deciduous tree was the American Elm (*Ulmus americana*); it attains a large size, and has a beautiful fountain-like disposition of branches. *Myrica cerifera*, the Stags-horn Sumach (*Rhus typhina*), *Rosa humilis*, and species of *Cornus*, were common; and *Onoclea sensibilis* and *Asclepias Cornuti*, the latter in fine flower, were to be seen everywhere. The White Pine (*Pinus Strobus*) makes a striking object seen either singly or in masses, and on dry banks and along hedgerows and roadsides the Red Cedar (*Juniperus virginiana*), sometimes of considerable proportions, was conspicuous.

Here and there a colony of *Lilium canadense* in flower made a fine display, and a fine composite, a species of *Rudbeckia*, probably *R. hirta*, with orange-coloured ray florets and black-purple disk, was very effective.

The Virginian Creeper had climbed to the tops of large willows by stream sides, and in some spots various species of *Vitis* clothed some of the trees.

Washington is the best-planted city I have yet seen. No less than 64 species and varieties of trees are used for avenues; eleven maples, eight poplars, five elms (among them our two common European species), four oaks, three walnuts, three limes, two willows, two planes, two gleditschias, and two birches are used extensively. Some of the more striking of the other trees employed are the Ginkgo (*Ginkgo biloba*)—an avenue of which made a beautiful picture—the Kentucky Coffee (*Gymnocladus canadensis*), the Tulip-tree (*Liriodendron tulipifera*), *Kolreuteria paniculata*, *Phellodendron amurense*, the deciduous Cypress

(*Taxodium distichum*), *Paulownia imperialis*, *Cercis canadensis*, *Broussonetia papyrifera*, *Catalpa bignonioides*, &c. The European *Acer platanoides* succeeds better in Washington than the American Sugar Maple, and that form of the Eastern Plane known as *Platanus acerifolia* grows better, and is preferable as a street tree to the native American Button-wood (*P. occidentalis*) both here and in the neighbourhood of Boston. As a rule in both places the latter is much disfigured by the attacks of a microscopic fungus (*Glæosporium*).

The Silver Maple (*Acer dasycarpum*) grows rapidly, but soon gets thin in the middle; in order to keep it in a satisfactory condition it has to be kept cut back. The Box Elder (*Acer Negundo*), *A. Pseudoplatanus*, and the Horse Chestnut (*Aesculus Hippocastanum*) are amongst the least satisfactory subjects. Mr. W. R. Smith, formerly of Kew, now the Superintendent of the Botanic Gardens, is chairman of the Parks Committee, and to him is largely due the great success which has attended the efforts of this body.

In some of the small squares flowering shrubs do wonderfully well; I noted along Pennsylvania Avenue, Forsythias, *Prunus Pissardi*, *Pyrus japonica*, *Chimonanthus fragrans*, *Hibiscus syriacus variegatus*, *Berberis Thunbergi*, &c. Amongst trees were fine examples of Weeping Willow, Kentucky Coffee, *Tilia petiolaris*, some American Oaks, and Abele Poplar.

Fuchsias do well from March to June; after that the temperature becomes too high for them. As a rule, it is too hot also for the great majority of open-air herbaceous plants. Many semi-tropical or tropical plants do wonderfully well bedded out during the summer months; among these I noted Crotons (Codiæums), finely coloured *Desmodium gyrans*, the Telegraph plant, grows freely and ripens seed in the open. *Antigonum Leptopus* also grows vigorously and flowers profusely. *Paullinia thalictroides* makes a charming edging, as also do *Peristrophe augustifolia variegata* and *Duranta Plumieri variegata*. *Aristolochia elegans* climbs over garden fences and flowers freely, and *Stigmaphyllon ciliatum*—with us a climber in the Palm Stove—grows as freely as does Ivy or Virginian Creeper at Kew, and in August and September produces a profusion of yellow flowers. *Phrynium variegatum* does well in shade, bedded out in full sun it burns. Other stove plants which do well in the open are *Phyllanthus atropurpureus* and *P. niveus*, *Cordyline* (Dracænas), *Pandanus*, &c. *Russellia juncea* makes an excellent subject for vases. *Vinca rosea* and its white flowered variety flower as profusely and grow as well, treated as bedding plants, as do scarlet geraniums in England. In a large unheated basin, about 120 feet in diameter, *Nelumbium speciosum*, tropical water-lillies, and *Victoria regia*, produce a fine effect. The latter had not fully developed at the time of my visit, but I was informed that last year a plant covered a space of 49 feet in diameter, and some of the leaves measured 7 feet 7 inches across. One of the most noteworthy of the Nymphæas was one named *N. pygmæa hybrida*, a charming small-leaved plant with pale canary-yellow petals, and deep yellow stamens.

A huge mass of tall-growing grasses about 40 yards in diameter was very telling; the centre was made up of the Provence Reed (*Arundo Donax*), and round this were clumps of *Erianthus Ravennæ*, *Miscanthus japonicus* (*Eulalia japonica*), and *Miscanthus sinensis* (*Eulalia gracillima* of gardens), &c.; the Pampas grass had already all been killed by the frost of the preceding winter.

Cynodon Dactylon forms the bulk of the turf of the lawns, it stands drought well, but turns brown and becomes disfigured when frost comes.

The Soldiers' Home, situated on high ground outside the city, is surrounded by fine grounds containing many remarkable specimens of native and exotic trees. On dry banks and along roadsides not far from here *Lonicera japonica* has become naturalised in great quantity, and has all the appearance of a truly native plant. In the woods, *Smilax herbacea*, *S. rotundifolia Podophyllum peltatum*, *Goodyera pubescens*, and *Chimaphila umbellata* were seen; all these are desirable and beautiful garden plants cultivated at Kew. A fine mass of the Indian Pipe (*Monotropa uniflora*), with about 100 stems about 9 inches high, each bearing a large waxy-white flower, was a beautiful sight; I am not aware that anyone has yet succeeded in cultivating this handsome parasite.

Washington to Roan Mountain.

On the evening of July 6th I left Washington for Johnson City, Tennessee, a distance of 455 miles. After leaving Pulaski, a pleasant summer resort at the foot of the Alleghanies, I saw *Rhododendron maximum* in flower in the woods through which the railway passes. *Kalmia latifolia* was also conspicuous, and *Itea virginica* with its racemes of white flowers. *Ceanothus americanus* was in flower on sunny bluffs, and in damp spots *Cimicifuga racemosa*, the Black Snakeroot, threw up its stems upwards of 6 feet high, bearing long racemes of white flowers. The Viper's Bugloss (*Echium vulgare*), a British weed introduced to and naturalised in the United States, afforded masses of blue in the pastures, and also in dry wild uncultivated spots; in some parts of Virginia, Tennessee and North and South Carolina this plant has become a very troublesome weed. From Johnson City a narrow-gauge railway runs to Cranberry, through the Doe River Canon, 1,500 feet deep, one of the most wild and picturesque spots in Eastern North America. Some of the trees and shrubs noted here in a wild state were the tulip-tree, Sassafras, *Castanea americana*, *Magnolia acuminata*, *Platanus occidentalis*, several species of *Cornus*, *Viburnum*, *Ceanothus americanus*, &c.

Rhododendron maximum and *Kalmia latifolia* grew everywhere along the edges of the wood above the watercourse. In a wood close to Roan Mountain Station I noted *Oxydendron arboreum*, *Mitchella repens* in flower and fruit on damp rock ledges, the Mayflower of the New Englanders (*Epigæa repens*) a beautiful ericaceous trailing shrub not very easy to grow well in Britain, *Adiantum pedatum*, *Aspidium acrostichoides*, &c.

The mountain road which runs from Roan Mountain Station (2,700 feet above the sea level) to Cloudlands, an hotel built on the summit of Roan Mountain, 6,315 feet above sea level, and said to be the highest human habitation east of the Rocky Mountains, is about 12 miles long, and part of the distance runs through exceedingly rich deciduous forests. No visitor interested in trees could fail to be struck by the criminal waste of the mountaineers. Blocks of land were treated in the most primitive fashion, the fine trees were "deadened," *i.e.*, killed by ringing, and the dead stems allowed to stand until they rotted and fell.

The following description is from the address of the late Dr. Asa Gray, in 1884, at Montreal:—"The Alleghany or Appalachian

Mo. Bot. Garden.

" Mountains which separate the waters of the Atlantic side from those " of the Mississippi . . . . . . in North Carolina and the " adjacent borders of Tennessee, rise to their highest altitude, and take " on more picturesque forms. On their sides the Atlantic forest, " especially its deciduous leaved portion, is still to be seen to great " advantage, nearly in pristine condition, and composed of a greater " variety of genera and species than in any other temperate region, " excepting Japan. And in their shade are the greatest variety and " abundance of shrubs, and a good share of the most peculiar " herbaceous genera. This is the special home of our Rhododendrons, " Azaleas and Kalmias—at least here they flourish in greater number " and in most luxurious growth. *Rhododendron maximum*, which is " found in a scattered way even as far north as the vicinity of " Montreal, and *Kalmia latifolia* (both called Laurels), even become " forest trees in some places. More commonly they are shrubs, " forming dense thickets or steep mountain sides, through which the " traveller can make his way only by following old bear paths, or by " keeping strictly on the dividing crests of the leading ridges. Only " on the summits do we find *Rhododendron catawbiense*, parent to so " many handsome forms in English grounds, and on the higher wooded " slopes the yellow and the flame-coloured *Azalea calendulacea ;* on " the lower, the pink *A. nudiflora* and the more showy *A. arborescens*, " along with the common and widespread *A. viscosa*."

" On these mountain tops we meet with a curious anomaly in geographical distribution. With rarest exceptions plants which are common to this country and Europe extend well northward. But on these summits from Southern Virginia to Carolina, yet nowhere else, we find, undoubtedly identical with the European species, the Lily of the Valley."

There are three distinct zones of vegetation, the lower is fairly limited by maize, which is grown in small quantities in the forest openings; some of the trees and shrubs noted in this belt were *Rhododendron maximum*, *Kalmia latifolia*, *Magnolia acuminata*, *M. Fraseri*, *Hydrangea arborescens*, *Ceanothus americanus*, *Prunus pennsylvanica*, *Castanea americana*, Tulip tree (twenty feet in girth), *Aesculus flava*.

In the intermediate belt, which ranges from the upper limit of maize cultivation to the lower limit of *Rhododendron catawbiense*, many of the trees of the lower belt also occur, but as we ascend various birches, *Nyssa*, Bass-wood, enormous beeches, &c. take their places, becoming more stunted, until the third zone is reached, and a sub-alpine flora obtains—*Abies Fraseri*, *Picea nigra*, *Pyrus americana*, *Crataegus coccinea*, *C. punctata*, *Alnus viridis* and *Rhododendron catawbiense* being the characteristic trees or shrubs. Small shrubs are *Leiophyllum buxifolium*, *Vaccinium erythrocarpum* (a species recently introduced to this country through the Arnold Arboretum), *Menziesia ferruginea*, *Ribes rotundifolium*, *R. Cynosbati*. A few of the herbaceous plants of this belt are Bluets (*Houstonia serpyllifolia*), *Houstonia purpurea*, *Saxifraga leucanthemifolia*, *Potentilla tridentata*, the rare *Lilium Grayi*—a beautiful lily which under cultivation at Kew attains proportions never seen in its native habitats, *Pedicularis canadensis*, &c. Too much space would be necessary to give anything like a list of the large number of trees noted on Roan Mountain. My best thanks for much information and for much time and trouble in guiding me to spots I should not otherwise have seen during a few days stay in this neighbourhood, are due to the Rev. Dr. Edson and his son, Mr. Elmer R. Edson.

JOHNSON CITY TO ST. LOUIS.

Quercus alba, the White Oak, is a very common tree about Johnson City, and attains a large size. The Hemlocks have been mostly cut down both for their timber and for the bark which is in great demand for tanning purposes. In Watausee Park, a piece of ground reserved as a park for Johnson City, I noticed some fine Black Walnuts and also Persimmons. About Chattanooga, on the left bank of the River Tennessee on the borders of the States of Tennessee and Georgia, Sweet Gums (*Liquidambar styraciflua*) occurred in large numbers, also the Plane or Button-wood (*Platanus occidentalis*), and the Shingle or Laurel Oak (*Quercus imbricaria*). On the banks of the Tennessee River, large trees of Silver Maple, Willow, Black Walnut, Sugarberry or Hackberry (*Celtis occidentalis*) were clothed to their very tops in a dense mass of Virginian Creeper, *Aristolochia*, &c., and the long pendent liane-like branches gave quite a tropical aspect to the scene. The large red pods of the Honey Locust (*Gleditschia triacanthos*) were particularly conspicuous and easily recognised in the mass of greenery. Both apples and peaches were largely grown about here, and in the gardens near houses fine plants of *Hibiscus syriacus*, and here and there *Lagerströmia indica*.

About Bridgport, in Alabama, the Trumpet-creeper (*Tecoma radicans*) was finely in flower on the railway banks, and high up the trees bordering the Railway was *Bignonia capreolata* also in flower. The Willow Oak (*Quercus Phellos*), the Post Oak (*Q. obtusiloba*), the Black Jack (*Q. nigra*), and Persimmon (*Diospyrus virginica*) were conspicuous in the forests through which the railway passed. *Belamcanda chinensis*, or as it is more frequently called *Pardanthus chinensis*, the Blackberry Lily, a handsome Chinese irid, is naturalised in abundance on the dry railway banks and was finely in flower. Amongst the deciduous trees, in more or less swampy openings in the forests, the Red Cedar (*Juniperus virginiana*) of considerable size was frequent. Close here too the first Cotton fields were noticed. A beautiful leguminous plant was growing in masses on the railway banks; this was probably *C. occidentalis*, a tropical American species naturalised in the Southern States. Near Larkinsville a dwarf Indian Fig (*Opuntia*, probably *O. vulgaris*) was growing amongst rocks. The immense cymes of *Sambucus canadensis* were noticed along the railway banks everywhere.

Leaving Cairo for Du Quoin, in addition to nearly all the trees, &c., above mentioned, I noticed masses of *Aralia spinosa* in flower along the railway, and gorgeous breaks of colour furnished by masses of *Phlox paniculata*—the parent of so many of our popular garden Phloxes, and *Rudbeckia hirta*; the flowers of the former were borne in large panicles, and were pink-purple in colour, the flower-heads of the latter were orange yellow (ray florets) and black purple (disk). One of our commonest native mulleins (*Verbascum Thapsus*), introduced into the New World, was abundant here. I had never missed a day without seeing this species after landing in New York. *Veronica virginica*, Culver's-root, a beautiful species cultivated at Kew and elsewhere, showed above the dwarfer herbage of the railway banks, its tall stems terminated by racemed panicles of white flowers. In many parts of the country the only bits of undisturbed prairie ground are the strips bordering the railway, so a study of these is necessary for anyone who desires to form an idea of what the aboriginal prairie flora was like in these regions.

Asclepias tuberosa, the butterfly-weed or Pleurisy-root, in dry spots furnished glowing masses of bright orange-red flowers; the plant grows from one to two feet high, and is one of the showiest species of the genus. Red Birch (*Betula nigra*) of great size were noticed here and there in swampy spots. In the backwaters of the Tennessee River the yellow Lotus (*Nelumbium luteum*) occurred in large quantities; this stately and beautiful plant, even near its native habitats, is difficult to establish, and in England we can never hope to see it growing and flowering so freely as it does under the burning sun of the Southern States. Near Carbondale, on the dry railway banks, I noticed *Rhus glabra* and a charming *Cassia*, about a foot high with a wealth of large yellow flowers; this is the Partridge Pea, *Cassia Chamæcrista*. Here and there along the small streams flowing into the Mississippi, and in swamps, I noticed the "Large Cane," *Arundinaria macrosperma* making almost impenetrable "canebrakes."

THE MISSOURI BOTANICAL GARDEN,

Or, as it is more commonly called, Shaw's Garden, was founded and endowed by Henry Shaw, an Englishman, who went to America in 1819, and settled at St. Louis, where he speedily amassed a fortune. Mr. Shaw was a great lover of plants, and brought together a very considerable collection to which he freely admitted the public. About 1858 he conceived and began to put into execution a plan for converting his garden into a scientific institution, somewhat after the model of Kew. Mr. Shaw died in 1889, and left nearly the whole of his estate, appraised at about a million and a third dollars, as an endowment for the garden. This endowment consists almost entirely in real estate, some of which, in the business part of the city, yields a large revenue; but the greater part of the land is in the immediate vicinity of the garden, and at present yields no income, though in time it promises to produce a very large maintenance fund. Under the will of Mr. Shaw, the garden is open (free) to the public daily, from 8 a.m. until half an hour after sunset, excepting Sundays, Christmas, New Year's, and Thanksgiving days, and the 4th of July. On the first Sunday each in June and September it is open from 2 p.m. until sunset. Generally speaking, the rules regulating the admission of the public are the same as those which obtain at Kew. Permits are given to photographers, but with the understanding that a print of each negative taken shall be sent to the director, with permission to publish or otherwise use it in case he should see fit to do so. An interesting experiment is now being tried in the technical education of gardeners. The trustees have established six scholarships of four years' duration for pupils who have passed a preliminary examination to the satisfaction of the director; these pupils are paid a sufficient sum to cover their board, and they are all lodged together and have the use of a reading room, containing the principal text books on gardening and the leading current American as well as English and other foreign horticultural periodicals. During the first year of their apprenticeship the pupils must work at the practical duties of the garden nine or ten hours daily, exactly the same as the regular employés. After the first year, one half of each day is given to manual work the remainder being devoted to class work, of which a carefully thought out scheme has been published by the director. Should, however, a pupil not show sufficient ability in his work and studies to satisfy the director that it is advantageous for the scholarship to be held by him, he forfeits his claim to it.

Under the energetic management of Dr. W. Trelease, the director, a fine free library has been got together and well arranged, and the herbarium of the establishment is on a very satisfactory footing. The large collections of the late Dr. Engelmann, of St. Louis, are kept distinct, but the Bernhardi herbarium is merged into the general collection. The horticultural library, pure and simple, is arranged separately from the botanical one, which is particularly rich in pre-Linnæan literature. A museum, too, is one of the features of the Garden.

Some of the living collections here are notable, especially the Cacti, Agaves, &c. The Palms are good, and one particularly interesting fact connected with these is that they are grown out of doors in summer and kept in a hollow-walled dark roofed house, double-glazed at both ends and front, in a low temperature (40°-45° Fahr.) during winter. *Pandanus Veitchi*, and other similar plants which do so well outside during summer are wintered with the Palms in the large house above mentioned, the secret of their being able to withstand so low a temperature is that they are all kept as dry as possible, only enough water being given to prevent the plants from actually parching. Tropical Nymphæas, *Euryale ferox*, *Eichornia speciosa* (*Pontederia crassipes*) do well, and were flowering freely in tanks or in tubs sunk in the ground outside.

At St. Louis tuberous-rooted Begonias refuse to grow ; it is apparently too hot for them. Roses do not thrive so well as in England ; a covering of six inches of pine needles is necessary to protect them from the severity of the winters—5° to 7° below zero in ordinary winters ; once in 20 years or so the thermometer falls for a short time to – 20° Fahr.

Pandanus, *Sanchezia nobilis*, Acalyphas, *Vinca rosea*, Codiæums (Crotons), *Hibiscus rosa-sinensis* and other plants which in England require stove treatment do well bedded out at St. Louis.

The Arboretum contains a good collection of deciduous trees, but nearly all those planted by Mr. Shaw are in straight lines, and consequently present a very formal aspect. The Norway Spruce at one time seems to have been largely planted, but in this district, as in so many other parts of the State where I have seen it, it is a most unsatisfactory tree. Fine deciduous Cypresses, *Abies nordmanniana*, Ginkgos, White Pine, and a remarkable *Pinus banksiana* are amongst the most noteworthy of the Conifers.

In the Arboretum advantage has been taken of a water supply to make a Lily pond, the banks of which are fringed by numbers of native moisture-loving plants. A bog garden, too, is of special interest here, and in special beds among the trees are cultivated between 1,000 and 2,000 native herbs and undershrubs. The Missouri Botanical Garden is no doubt destined to exert a great influence. Mr. Gurney, the Curator, is an old Kew man, and in addition to his duties at Shaw's Gardens, he is also Superintendent of Tower Grove Park, which was presented to St. Louis by Mr. Shaw. *Pinus montana*, the mountain pine of Switzerland, &c., grows famously here ; it certainly is much more vigorous than ever I saw it in its native habitats.

St. Louis to Chicago.

Besides many of the plants already mentioned as having been seen on the railway banks, I noted before arriving at Chicago masses of the Prairie Rose (*R. setigera*), the only wild climbing rose in North America ; strong shoots grow from 20 to 30 feet in a season. This beautiful plant is now attracting the attention of American growers, and it should be more frequently seen in this country ; it is extremely hardy, and produces a profusion of flowers of deep rose colour changing to white. *Vernonia noveboracensis*, a tall-growing handsome composite with purple flower-heads was seen intermixed with the golden-orange flowered *Rudbeckia hirta*. The Compass plant, *Silphium laciniatum*, with its large cut leaves disposed in open places so as to present their edges north and south, was abundant, and so also was *S. terebinthaceum*, the Prairie Dock, a still taller plant with large uncut ovate leaves; the flower heads of the former are somewhat racemed and are larger than those of the Prairie Dock, whose tall stems 6 to 10 feet high, bear panicles of small yellow heads.

CHICAGO.

In order to give some idea of the difficulties encountered by those who had to prepare Jackson Park for the purposes of the "Columbian Exposition," it may be well to quote the following extract from a "Report upon the Landscape Architecture of the Columbian "Exposition," drawn up by Dr. Olmsted at the request of the American Institute of Architects, and a resumé of which was published in "Garden and Forest" for August 30th, 1893. "To ordinary observation, Jackson Park was a forbidding place. At different periods "sandbars had been formed in the lake a few hundred feet from the "shore, and parallel with it. The landward one of these, gradually "rising, had at length attained an elevation above the surface of the "water, and within this bar a pool or lagoon was formed. Gradually "these lagoons had been filled nearly to the brim with drifting sand "and had become marshes. Thus nine-tenths of the site, in fact, all "of it, that had not been artificially made otherwise, consisted of three "ridges of beach sand, with intervening swales occupied by boggy "vegetation. Upon the two inner ridges vegetable mould had gathered "and scattered groups of oaks and other trees had sprung up. . . "After all the operations of draining, grading, and top-soiling the "land, the great bulk of the planting operations had to be completed "in one fall and spring, two years being the longest time at command "at any part of the grounds, and yet it was necessary to avoid the "weak and sickly appearance so often seen in freshly made plantations. ". . . Several miles of raw, newly-made shore had to be covered "with a graceful and intricate green drapery of varied tints and "pleasing in its shadows and reflections, and yet no commercial agencies "were prepared to furnish the material. The chief reliance was "placed upon willows of the shrubby sorts, in large variety, and such "herbaceous bog and water-side plants as flags, cat-tails, rushes, irises, "and pond lilies, most of which had to be gathered for the purpose "from localities on the shores of lakes and swamps in Illinois and "Wisconsin. In this work, 100,000 willows, 75 car-loads of herbaceous plants, 140,000 other aquatic plants, and nearly 300,000 "ferns and other herbaceous plants were used." To Dr. Olmsted and his partner, the late Mr. Codman, visitors to Chicago have been able to see a perfect example of true art in the management of the lagoons, and, in my mind, the water-margins will remain impressed as the most wonderful thing I saw in the "White City." A succession of native plants followed each other in flower, there was no sign of newness, everything looked as if it did not owe its position to human intervention.

The great Horticultural Building, a huge structure, its principal features being a dome (187 feet in diameter and 113 feet high), with wings connecting the dome area with the pavilions at the ends, is altogether an unsuitable structure in which to grow plants, some of the latter showing unmistakeable signs of distress very soon after being placed in it. What may be called the permanent plants were either planted out or arranged in groups in tubs. Several States had collected from many contributors large palms and other specimen plants of unequal merit as regards cultivation. One of the best from a gardening point of view was the exhibit of Ontario. Here many of the specimens were not particularly large, but nearly all showed evidences of skill and care on the part of the grower. A series of eight greenhouses, 24 feet by 100 feet, were used to keep up a supply of flowering and foliage plants. In these were raised, under identical conditions, large lots of cyclamens, primulas, cinerarias, &c., from seeds sent by numerous British, Continental, and American growers. At the time of my visit the houses contained some very fine Caladiums, tubers of which had been sent by various nurserymen. A good lot of chrysanthemums were also being grown on for autumn exhibition; here, as well as elsewhere, I found that chrysanthemums were not placed in the open air during summer as with us, probably the impossibility of being able to command sufficient moisture in the atmosphere except under glass is the reason for this method of cultivation.

Cacti.—Remarkably fine groups of cactaceous plants were exhibited by Mexico, and by Mrs. Nickels, Laredo, Texas. Both these were collected plants dug up and transplanted on rockeries; probably no plants in cultivation in Europe equal them in size and beauty. The largest exhibit of cacti was that of A. Blanc & Co., of Philadelphia, but most of these, including some large specimens of *Cereus giganteus*, which were flowering freely at the time of my arrival, were arranged in large beds on the front esplanade. Some of the most noteworthy species represented in the collections of the exhibitors just mentioned are *Echinocactus Le Contei*, six feet high, *E. Wislizeni*, over five feet high, *E. Pfeifferi*, nearly five feet in circumference, and grand almost spherical masses of *E. Grusoni*, a handsome plant with long lemon yellow spines. Masses of *Mamillaria*, *Echinocereus*, &c., were also especially attractive.

Cannas.—On the front esplanade of the Horticultural Building, the beds in the turf which had, in spring, been filled with pansies, were in mid July planted with cannas. In the United States cannas are amongst the most popular of all outdoor ornamental plants: they revel in the heat and bright sunshine. Large series of plants exhibited by Vaughan (Chicago), Pierson (New York), Dreer and Craig (Philadelphia), were massed, generally a bed of a sort, on the lawns. Madame Crozy still appears to hold the first place for size and beauty of flower, and vigour as well as habit. (A variety raised by Mr. Kanst, of Washington Park, Chicago, and named by him "Nicholson," has the habit of Madame Crozy, and is the best of its class I have seen; it has clear light canary-yellow flowers and light green leaves.) The best cannas, besides those just mentioned, appear to be J. D. Cabos, Alphonse Bouvier, Michel Coluvrat, Gustav Zehnholz, Capitaine B. de Suzzoni, Florence Vaughan, J. C. Vaughan, Mademoiselle de Crillon, and Secretary Stewart.

Plunged in the turf near the California State Building, a structure fashioned after the style of the Old Mission Buildings, I noticed in flower on July 18, *Poinciana Gilliesii*, Pomegranate, *Euphorbia splendens*, *Jasminum revolutum* (grown with a clear stem, and with a fine bushy head), *Romneya Coulteri*, some remarkably fine tea rose bushes, oranges, and oleanders. Foliage plants were also in abundance, including *Yucca Whipplei*, four feet across, *Erythea armata*, *E. edulis*, and several other palms, and a fine silver tree (*Leucadendron argenteum*), a Cape plant not easy to cultivate in Britain.

The Florida State building, a reproduction of Old Fort Marion, or St. Augustine, the oldest structure in America, was surrounded by a forest of *Yucca aloifolia* of various sizes.

In front of the building erected by the Territories of Arizona, New Mexico, and Oklahoma, there were some very fine succulents, a *Cereus giganteus*, 15 feet high, with a crested head 4 feet across, *Echinocactus Wislizeni*, Agaves, *Fouquiera splendens*, &c.

The garden surrounding the reproduction of the Convent of La Rabida was quite differently treated from any other spot in the grounds. Here, on the lake shore, *Elymus arenarius* formed large masses, *Artemisiæ*, *Cineraria maritima*, dwarf Opuntias, large Agaves, Dasylirions, *Phormium tenax*, *Glaucium luteum*, and sheets of Portulaca in full flower, formed a curious yet pleasing combination.

On the "Wooded Island" was the Rosary, covering an acre in extent, and laid out in geometrical fashion. The roses here, as well as elsewhere in the grounds, appeared to have done well, and to have given great satisfaction to the visitors, most of whom were much surprised with the "standards." Owing to the severity of the winters and the difficulty of efficiently protecting them, American nurserymen, many of whom are thoroughly acquainted with European methods, do not grow standard roses. Gladioli and lilies were planted in the rose beds, and the former were flowering during my visit.

Tuberous begonias and dahlias were poor; the climate seems too hot for them. The only good begonias I saw were in the gardens of Professor Sargent, at Holm Lea. Phloxes, as might be expected, do well; stocks, zinnias, and carnations were poor.

One of the features which could not fail to strike even the most superficial observer with any knowledge of gardening, was the wonderful display of fruit. A constant supply of fresh fruit was regularly kept up, and a lengthy report would be necessary to give even a faint idea of the importance of this branch of the "Exposition." Museum specimens, *i.e.*, fruits preserved in various solutions in order to exhibit their characters when fresh specimens were not to be had, were finer here than I had ever seen them. In the California Building were admirable series of oranges, lemons, olives, apples, pears, peaches, &c. Many of the exhibitors had methods of their own, which they refused to divulge. With some fruits a sulphurous acid solution was successful; with others chloride of zinc and boracic acid solutions do better. Alcohol bleaches and otherwise discolours most things, and this is evidently not much used. To very weak solutions of boracic acid and chloride of zinc an addition of glycerine is needed in order to make the fluid as nearly as possible of the same density as the fruit juices, otherwise such thin-skinned fruits as peaches, &c., soon crack and spoil.

From end of July onwards, lily of the valley was well shown; the crowns are kept in "cold storage," and only brought into heat about a fortnight or three weeks before they are wanted in flower, these were exhibited by Ernest Asmus, a large grower at West Hoboken, New Jersey.

A charming feature in Washington Park is the lily ponds; of these there are three, on different levels, so as to secure a flow of water; two of them are heated with steam pipes from the greenhouses, the third is unheated. The heated ponds are dedicated to the Victoria Regia, tropical water lilies, &c., the third to various aquatics. *Eichorniæ* *azurea* and ***E. speciosa*** were a mass of flower. Here it has been found desirable to raise *Nymphæa zanzibarensis* and *N. dentata* annually from seeds, instead of trying to winter the tubers ; seeds are sown in August of each year and are kept going in small tanks under glass. In a small tank 2 feet by 4 feet *Victoria regia* and the lilies are germinated; the tank is shallow, built on brick walls, and the requisite heat is obtained by keeping an ordinary paraffin lamp burning beneath. The larger tank, for growing on the various aquatics, is only 4 feet by 8 feet, and it seems a triumph of gardening skill to produce such a number of plants with such limited accommodation. At the entrance to the lily ponds a group of Oleanders, plunged in the turf, produced a fine effect; these plants are stored during winter in a dark shed just kept clear of frost.

Lincoln Park.—This noble park, upwards of 340 acres in extent, has been created from a succession of sand dunes, with a swale or two intervening. The low ground did not produce black soil enough to give a covering to the surface of the park of more than an inch in thickness, so in order to supply food for the trees and turf, dressings of manure and soil must be constantly given.

The lily ponds here are more extensive than those of Washington Park. In 1889 advantage was taken of a depression between two sand dunes, and two ponds were made of irregular outline, with walls and bottom of cement concrete. One of these was heated so as to permit the cultivation of *Victoria regia* and tropical water-lilies. This attempt was so successful that the following year a third pond was formed in a ravine still further north. The tender water-lilies are planted in large shallow boxes in the heated pond, and in July and August, when I visited the park, they presented a very beautiful appearance. The flowers of *Nymphæa zanzibarensis* measured 13 inches across, those of *N. dentata*, *N. Sturtevanti*, and *N. devoniensis* were also proportionately large; a plant of the last named was 18 feet across, and was bearing a number of its large red flowers. The Nelumbiums are not housed in winter like the tender lilies, but are permanently planted out in the unheated ponds; now and then, during winter, musk-rats find their way under the ice and play havoc with the rhizomes *Limnocharis*, *Eichornia*, and many genera which have to be grown under glass in England make a brave show under the hotter sun of Illinois. Colocasias, fine *Hibiscus*, and other beautiful foliage and flowering plants adorned the banks.

Another interesting and popular feature is a noble herbaceous collection. This is arranged on each side of a glassy glade about 900 feet long, the borders following the sinuosities of the backing of trees and shrubs. Here large masses of sunflowers, *Heliopsis lævis*, tiger lilies, *Liatris*, campanulas, and other native and exotic perennials, were thriving admirably.

A fine group of houses, fourteen in number, were interesting and instructive from many points of view. They are probably the finest set of plant houses in America. The use of perishable materials in their construction has been avoided as much as possible. The roofs are composed of steel and glass, even to the glazing bars, which are of steel (Helliweel patent). The glass is rough-ribbed plate, quarter inch in thickness. In the palm house all the specimens were planted out and were growing vigorously; palms, cycads, ferns, ficus, &c., were in the rudest health; the undergrowth was selaginella, &c. The entire group of houses is fitted with an apparatus which automatically regulates the heating and ventilation; the steam valves are worked by compressed air, and there is a thermostat in each house. The boilers are above 350 feet distant from the palm house, and any difficulty arising from friction in the pipes (for hot water can be, and is, used as well as steam) or by violating the laws of gravitation, is overcome by a steam pump in the return pipe near the boiler. We learn from the Superintendent's Report, dated January 1st, 1892, that the heating apparatus has abundantly fulfilled the conditions imposed; "an even temperature of 58° to "60° being maintained during the coldest night of this winter, when "the thermometer reached 19° below zero, with a strong wind blowing."

The Waukegan Nurseries.—The nurseries of Messrs. R. Douglas and Sons are situated on the western shore of Lake Michigan, about 35 miles north of Chicago. Mr. Douglas has an extraordinary practical knowledge of native American trees, having observed them for 50 years or more under widely different conditions. Here was first begun the raising of conifers from seed on a vast scale. After many experiments and some costly failures, Mr. Douglas discovered that the methods pursued in England could not be trusted in the hot, dry climate of the United States, but he finally succeeded in securing proper conditions of shade and moisture by the device of covering high frames with the leafy boughs of forest trees. Under such frames, at the time of my visit in mid July, I saw hundreds of thousands of fine healthy seedlings of such plants as the white pine, European larch, Colorado blue spruce (*Picea pungens*), white spruce (*Picea alba*), *Abies concolor*, &c. The Colorado Douglas fir is also grown here largely, the form from the Pacific Coast being not hardy. Here also I had the pleasure of seeing probably the first seedlings ever raised of the weeping spruce, *Picea breweriana*, a rare conifer first figured in the *Gardeners' Chronicle* for April 17th, 1886. The trees grow on the north side of the highest peaks of the Siskiyou range in N. California, where in winter the snow lies 15 or 20 feet deep, so it may be presumed that the species will be hardy enough with us; it is to be hoped that it will thrive under cultivation, as there are but few groups known in a wild state, consisting of few individuals.

Some of the strange forms of conifers propagated and distributed from Waukegan are the very dwarf, compact form of the American arborvitæ known as Douglas's little gem, the Waukegan trailing juniper (*J. Sabina*, var. *prostrata*), a silver-tipped American arborvitæ, a golden form of the same species, and a remarkably deep gold-coloured juniper.

I had the opportunity of seeing and examining in flower Teas' hybrid catalpa in the nursery; it is intermediate between *C. Kæmpferi* and *C. bignonioides*, and is hardy at Waukegan, whilst *C. bignonioides* cannot withstand the severity of the winters.

In a second-growth wood on high ground, not far from Mr. Douglas's nursery, in a spece hardly more than an acre in extent, I counted and noted no less than 24 species of trees and shrubs, and as undergrowth observed the American cowslip (*Dodecatheon Meadia*), here called shooting star, *Adiantum pedatum*, *Osmunda*, Indian Turnip (*Arisæma triphyllum*), *Podophyllum peltatum*, *Trillium sessile*, conspicuous by reason of its blotched leaves and purple flowers, and in open spots *Lilium superbum* and *Campanula americana*.

On low ground by Lake Michigan, at a spot called Big Dead River, I saw European larch, Scotch fir, and Austrian pine, which had been planted by Mr Douglas; all were thriving and promised to make timber trees. On the sand dunes the most characteristic plant was the creeping juniper *J. Sabina*, var. *prostrata*, which makes a dense green carpet a few inches high and binds the sand, a task it shared in some spots with

Arctostaphylos Uva-ursi, a much more vigorous form than the one we are accustomed to see in Europe. *Ceanothus*, *Potentilla fruticosa*, *Betula pumila*, *Amorpha canescens*, *Rosa humilis*, *Hypericum kalmianum*, *Prunus virginiana*, the choke cherry, dwarf willows, &c., were amongst the shrubs noted. In damp spots amongst grass were large numbers of *Calopogon pulchellus*, a pretty terrestrial orchid with large rose-purple flowers; *Tradescentia virginica*, *Actæa spicata*, var. *rubra*. with its racemes of red berries; *Lysimachia longifolia*, a graceful loosestrife, well worth a place in English gardens; and *Castilleia coccinea*, with its bright scarlet bracts; in this part of the country the species just mentioned goes under the name of Indian pink. Under the trees in damp spots the mocassin flower, *Cypripedium spectabile*, the handsomest species of the genus in North America, was not uncommon.

MOUNT HOPE NURSERIES, ROCHESTER.

The sole reason for my stay in Rochester was to see the famous nurseries of Messrs. Ellwanger and Barry. Surrounding the offices of the firm is an extensive lawn studded with specimens of rare trees and shrubs; and the belt of ornamental trees, &c. which separates the nursery ground from the lawn in question, and also from the street, is full of good things, the full history of each being known to the proprietors. Among the specimens on the lawn I noted a large *Magnolia macrophylla* covered with fruit, fine Japanese maples, large *Magnolia conspicua*, and a very fine cutleaved European birch; this is a charming tree in America, and seems to grow better there than in England; at any rate, I have never seen such beautiful trees in this country as I have seen in such widely separated places as Washington, St. Louis, Rochester, New York, &c. Our native *Viburnum Lantana* has an honourable place and is valued for its brightly coloured fruits. At Kew this is grown as an ornamental shrub, but in how many other establishments in England is it to be found as a garden plant? A large blue spruce is a conspicuous object, and so is *Acer Ginnala*, which here assumes tree-like proportions. A fine *Ulmus montana*, var. *superba*, a large-leaved form of our wych elm, was, Mr. Ellwanger informed me, a year-old plant received from Van Houtte in 1842. The finest specimen of *Fagus sylvatica*, var. *crispa*, I ever saw is here; it is about 30 feet high. Good trees of *Pinus ponderosa* and the Austrian pine, which does well here, were among the best conifers.

At present the nurseries cover an area of 600 acres, about 400 of which are devoted to young fruit trees. Everywhere there was good cultivation and clean, well-grown stock. The fruit trees for sale are grown in rows three feet apart, and the weeds are kept down and the surface of the ground kept from baking by regular stirring with "cultivators" drawn by horses. In order to grow the trees under the best possible conditions, a new farm is taken every few years, so that before the ground is "tired out" for young trees it is given up perfectly clean and in excellent heart to other crops, and new ground is used for the next few years. Under such management insects or fungoid diseases, &c. do not cause any trouble, and in the latter half of August the stock was a perfect picture of health and vigour. The firm everywhere acts according to the maxim that what is worth doing is worth doing well. One remarkable feature of the place is a large collection of nearly 400 varieties of pears in a fruiting state, apples, cherries, plums, &c., on a proportionately equally large scale. No similar attempt, on so broad a scale, has been made in America either by individuals or by Government. Although so many varieties are grown, comparatively few are propagated, only those, in fact, which, by actual observations spread over many years, have proved to be the best of their respective classes.

Amongst herbaceous plants the same principle obtains; phloxes are imported as soon as sent out in Europe, these are grown side by side and duly proved, only the best being catalogued. Amongst herbaceous plants I was struck with a large plot of our birds' foot trefoil (*Lotus corniculatus*), probably a greater number of plants than exist under cultivation in all the gardens of England put together.

An experimental vineyard of 20 acres was a fine sight. All the different varieties of Vines which thrive in the open air here are experimentally tested, and only those propagated which satisfy the firm.

Roses are represented by 15 acres of dwarf, own root, and budded plants. The Manetti is the stock used and, according to the experience of Messrs. Ellwanger and Barry, many varieties grown on this stock adapt themselves to a greater range of climate and soil, bloom more profusely, endure the summer heat better, and make stronger plants than when on their own roots.

Elæagnus longipes is grown in enormous numbers in pots, and so are many varieties of the Prairie Rose (*Rosa setigera*). *Pyrus japonica*, in all the best sorts, is propagated from root-cuttings on a vast scale.

Prunus Lauro-cerasus var. *schipkaensis*, a variety of the Cherry Laurel, introduced from the Shipka Pass by Späth, of Berlin, a few years ago, is hardy at Rochester, and is worth noting as a valuable evergreen shrub; the other varieties will not stand in this part of New York State.

In this neighbourhood *Gleditschia triacanthos*, the Honey Locust, is largely used as a hedge plant, and if properly attended to makes an efficient fence. At Mount Hope Cemetery I noted the finest *Hibiscus syriacus* I ever saw, splendid bushes 18 feet high and as much through, laden with flowers.

DOSORIS.

This is the name of a small island lying on the north shore of Long Island, New York. It was bought about 20 years ago by Mr. Charles A Dana, its present proprietor, and now the entire island, about 45 acres in extent, is all garden. A sea wall is built all around the island, and it is now draped and festooned with *Lycium vulgare* (Matrimony Vine) a plant introduced from Europe and now naturalized in many places, the Bitter-Sweet (*Celastrus scandens*), a Japanese species of the same genus (*C. articulata*) and *Periploca græca.* Behind these come *Elæagnus*, *Tamarix*, and various species of *Prunus*. On the banks, exposed to the lashing of storms, are the Locust (*Robinia Pseudacacia*), *Juniperus virginiana*, the Wax Myrtle (*Myrica cerifera*), the Button-Bush (*Cephalanthus occidentalis*), the White Mulberry (*Morus alba*), &c. Many of these stand spray and wind well, and some of them have their roots almost in the salt water. An excellent object lesson in seaside planting can be obtained by a visit to Dosoris. Now and then a high tide comes over some of the shrubberies and the results are noted. *Spiræa prunifolia* does well even where sprayed with salt water; *S. Thunbergi* will not grow at all under such conditions. *Taxodium distichum* var. *pendulum*, a very curious form of the common deciduous cypress of the Southern United States, more generally known under the name of *Glyptostrobus pendulus*, is also a good seaside tree. *Quercus obtusiloba*, about the northern limit of its range, makes a stately tree.

Perhaps the glory of Dosoris is the large collection of Conifers. A number of these thrive which cannot withstand the severity of the winter about Boston. Perhaps the largest Wellingtonia (*Sequoia gigantea*) on the eastern side of the American continent is to be seen in Mr. Dana's garden; a handsome *Pseudolarix Kæmpferi* and a host of specimen pines and firs too numerous to mention. Unsparing use is made of the knife whenever a fir or pine shows the slightest tendency to become thin; the head is cut out, and the consequence is that lateral branches are kept from getting bare and unsightly. In a year or two new leaders (all of which are cut out except one) are formed and compactly grown ornamental specimens are the result.

Azaleas, the Ghent hybrids, are largely grown, and a hedge of *A. amœna* was the finest I ever saw. Mulching is practised largely with these, and most other plants at Dosoris, and the value of this protection both against excessive drought in summer and frost in winter cannot well be over-estimated.

Gardening altogether is remarkably well done, a former Kew man, Mr. W. Falconer, is in charge.

KISSENA NURSERIES.

These nurseries, the present head of which is Mr. Samuel B. Parsons, are situated at Flushing, Long Island. They were formed more than 50 years ago, and the influence they have exerted is to be seen in the well planted streets of this pleasant town. The Pin Oak (*Quercus palustris*) made a stately avenue, so did the Over cup Oak (*Q. macrocarpa*); the former does well but the latter apparently requires the hot summers of its native land to enable it to thrive, as I have never seen outside the United States such fine trees as are to be found at Flushing and elsewhere. The Silver Maples (*Acer dasycarpum*) is, as in most other eastern American towns, a fine avenue and street tree. The White Willow (*Salix alba*), naturalized in many places, does well, as a street tree, and presents a graceful and picturesque outline. *Taxodium distichum* var. *pendulum* in thirty years has grown rapidly and formed tall narrow based pyramids of great beauty. The Sweet Gum (*Liquidambar styraciflera*) is also a successful tree for town streets; fine examples are to be seen here Other street trees noted are *Tilia platyphyllos*, English Beech (*Fagus sylvatica*), Norway Maple (*Acer platanoides*), Sugar Maple (*A. saccharinum*), and Tulip tree. On ground formerly occupied by the nursery stand the finest specimen of *Pseudolarix Kæmpferi* I ever saw, a stately tree 50 feet high. Not far off, also on the old nursery ground, stands the finest weeping beech I ever saw; this was planted in 1842. It is upwards of 60 feet high, and the circumference of the circle where the hanging branches meet the ground was 180 feet five years ago. The trunk is 6 feet in circumference 3 feet from the ground, and a man standing by it is perfectly concealed from those without the circle by the thick curtain of foliage. Near this I noticed a plant of *Magnolia macrophylla* 35 years old, which was 40 feet in height, with a spread of branches about 40 feet. Other noteworthy trees were *Picea orientalis* 50–60 feet, *Abies concolor* 50 feet, *Abies cephalonica* 50 feet, a very large tree of the Purple Beech, &c. *Cratægus Pyracantha* was noted as an excellent hedge plant.

In grounds near the residence of Mr. Parsons I noticed a wonderfully fine specimen of the cut-leaved form of our English beech, and the finest specimen I ever saw of *Tilia petiolaris*, a stately tree 70 feet high, which Mr. Parsons informed me was 50 years old. Japanese maples are very fine here, as well as many other choice Japanese shrubs. Many trees collected by Dr Hall, Mr. Hogg, and other American travellers in Japan first found their way into general cultivation through the Flushing nurseries, and as a consequence there are finer specimens of some species here than are to be seen elsewhere ; *Magnolia stellata*, 12 feet high, is a case in point. *Vitis inconstans* (better known as Ampelopsis Veitchi) has climbed in 10 years 60 feet up an old tree. A large bush of *Cercis chinensis*, 15 feet high, and as much through, was the largest specimen of the species I ever saw. We saw and admired a good Ginkgo, a fine Weeping Hemlock, and noteworthy specimens of Weeping Sophora, *Tamarix chinensis*, 35 feet high, *Magnolia cordata*, 50 feet high (this last is no longer known in a wild state, and is generally regarded as a form of *M. acuminata ;* Mr. Parsons states that it comes true from seed). The trunk of a double flowered cherry 5 or 6 feet through near the ground, separates a little higher up into eight or ten trunks, each as big as the stem of an ordinary cherry tree ; the height is between 60 and 70 feet. Just opposite Mr. Parsons' I noticed a fine fastigiate form of the Sugar Maple, which ought to be a general favourite, particularly where shade trees are wanted, but where sufficient room is not available for the widely spreading type.

A note on the influence of stock on scion may be of interest ; *Picea orientalis* does well here grafted on the Norway Spruce, and under such conditions, so Mr. Parsons says, keeps clear of red spider, which often sadly disfigures and cripples own-root plants.

NEW YORK TO PHILADELPHIA.

In company with Professor C. S. Sargent, I left New York on the evening of August 21st for Philadelphia. In marshes by the railway I noticed enormous tracts of the Indian Rice, or Water Oats, *Zizania aquatica*, a tall grass, the seeds of which are largely gathered for food by the North-Western Indians. The seeds, too, furnish food to countless water-fowl, and on this account several attempts have been made to introduce the plant into ponds, &c. in Britain ; many years ago Sir Joseph Banks cultivated the species in his garden at Isleworth. Along the ditch sides in the marshes *Hibiscus Moscheutos* was flowering freely ; it is a handsome perennial well worthy of cultivation as an ornamental garden plant. The Pin Oak (*Quercus palustris*) is common in the low grounds all along the route.

Fairmount Park.—In this park was held a few years ago the great Philadelphia Exhibition, and Horticultural Hall, one of the structures erected for the purposes of the Exhibition, still stands, a fine structure remarkably well cared for. It contains a number of very fine palms and other stately tropical plants, each being accorded plenty of space to show off its beauty to the best advantage. Most of the specimens are planted out, and there is a groundwork of *Selaginella*, interspersed with Marantas, Caladiums, *Remusatia*, &c. *Cocos plumosa* with *Monstera deliciosa* climbing up stem produced a fine effect, and a mass of bamboo (labelled *B. striata*), about 60 feet high, occupied a central position.

Some very fine tulip trees were noted as also very large white mulberries. Among other noteworthy trees were *Quercus tinctoria*, *Q. alba*, *Q. falcata* (the Spanish Oak), red maple, *Nyssa multiflora*, a fine healthy *Pseudolarix Kœmpferi* about 30 feet high, Gleditschias, &c.

Rhododendrons are not so good as we are accustomed to see them in England, nor are many other Ericaceous plants. Fine masses of *Gordonia pubescens* in flower, were perhaps the most beautiful objects I ever saw; this species is the rarest of all North American trees. " Discovered long ago in Georgia by the Philadelphia botanist, Bartram, " it has not been seen growing naturally for nearly a century, and has " only been preserved through cultivated plants." The bushes near the Horticultural Hall seemed perfectly at home, were about 12 feet high, and as much through; the large white fragrant flowers with golden-orange stamens are not unlike those of a single camellia. A useful descriptive catalogue of the trees and shrubs grown in Fairmount Park was prepared by Professor Rothrock of the University of Pennsylvania, and published 13 years ago. Fairmount Park is the largest city park in existence, having an area of 2,800 acres.

A wonderfully picturesque drive from the Fairmount Park by the Wissahickon, an alpine gorge in miniature, brought us to Germantown. A striking feature on the rocky slopes of the Wissahickon, was the beautiful blue colour afforded by innumerable plants of *Commelina virginica*, the pale yellow of *Impatiens pallida* and the red brown of *I. fulva* were also pleasing and effective. *Helianthus divaricatus*, *Rudbeckia pinnata* and *Vernonia noveboracensis* were the most showy composites in flower; the two first-named are yellow, the last a fine purple.

MEEHAN'S NURSERY.

This is a remarkable nursery and should be visited, if possible, by all lovers of trees. Here are cultivated in enormous numbers a large series of wild N. American deciduous trees and shrubs. Of the Flowering Dog wood, *Cornus florida*, there were upwards of 200,000 two year seedlings, and a large stock of older plants. Hickories, oaks, ashes, maples, &c. are raised from seed in vast quantities. There was quite a field of the Japanese *Hydrangea paniculata*, and about 100,000 of the handsome Japanese *Viburnum plicatum*.

Amongst the numerous specimen trees and shrubs are the following which of course only represent but a small proportion of the whole. Here is the original plant of the weeping *Cornus florida*, discovered in the woods near Baltimore which has been largely propagated and widely distributed from Germantown. A peculiar weeping form of *Ulmus americana* found near Galena in Illinois is a highly ornamental tree and deserves to be well known; shoots attain sometimes eighteen feet in length in a single season. A remarkably fine specimen of the South European *Zizyphus vulgaris*, about 40 feet high, was covered with young fruit. The original plant of *Halesia tetraptera Meehani*, a very distinct form raised from seed by Mr. Meehan is also here. A tall straight stemmed specimen, about 25 feet high, of *Pterostyrax hispidum*, which must have presented a beautiful sight when in flower, was, at the time of our visit, laden with its pendulous panicles of fruit. *Cedrela sinensis*, a Northern Chinese tree with much the aspect, as far as habit and foliage characters are concerned, of the Ailantus was represented by the most beautiful specimen I have yet seen; it was about 30 feet in height and had flowered freely this year. Perhaps one of the best plants of the curious *Hovenia dulcis* to be seen outside Japan, where its thick fleshy fruit stems are eaten, is growing in Mr. Meehan's nursery; it is about 30 feet high. A remarkable tree of the Japanese and North Chinese *Quercus dentata*, commonly known in English nurseries under the name of *Q. Daimyo*, is, in the opinion of Professor Sargent, one of the finest specimens to be seen either in the United States or in Europe. It has very large leaves, and where it thrives, is a stately and very distinct tree. Mr. Meehan informs me that this specimen was 15 years old, and as it was fully 30 feet high its hardiness and its value as an ornamental tree seem sufficiently proved as far as the neighbourhood of Philadelphia is concerned. A beautiful specimen of a very distinct weeping variety of *Prunus serotina* was also noted. A fastigiate form of *Picea Engelmanni* with very glaucous leaves was especially noteworthy; it is a compact, dense pyramid about eight feet high, and altogether is one of the most distinct and interesting conifers of recent introduction, the Germantown specimen was produced from a graft brought by Mr. Meehan from the timber-line on Gray's Peak in Colorado.

Up the side of the house and up to the top of a flag-pole at the end of the gable a plant of *Akebia quinata* had climbed and formed a splendid mass of green. Close by too I noticed the largest bush of *Clethra alnifolia* I had ever seen. The Papaw, *Asimina triloba*, grows wild in the neighbourhood of Philadelphia; in the nursery were nice fruiting bushes or small trees. *Pueraria thunbergiana*, a rampant climber sometimes met with in European gardens under the name of *Dolichos japonicus*, is here grown as a tall pillar plant, a column of greenery 15 feet high producing in August numerous dense recemes of sweet-scented flowers; in colour the standard is red with a yellow base and the wings are maroon. Big cherry trees, the stems girthing about 18 feet and tall in proportion, are striking objects here; they originated as seedlings from imported trees.

Elæagnus parvifolia makes a good hedge plant, and so also, in this neighbourhood, does the Osage orange, *Maclura aurantiaca*. *Lonicera japonica* clothes wire fencing with a thick growth and flowers profusely; when in flower it is constantly visited by humming birds.

There is a good collection of the best herbaceous plants. *Hibiscus grandiflorus*, a noble species, with large blossoms, white, with a blood-coloured eye, was in flower at the time of my visit. *Helianthus doronicoides*, a species not generally known, was also noted as specially good; it grows from four to five feet high, and has foliage very distinct from that of any other sunflower.

Germantown.—The streets of this suburb of Philadelphia are clean and well-planted, and every tree lover who can do so should see them. A 100 years ago the people here were interested in trees, and introduced and planted considerable numbers of rare species. The first botanical garden in the new world, the famous Bartram garden, now dedicated to the public use through the efforts of Mr. Meehan, is not far from here, and in every old garden near Germantown there are numbers of interesting trees. On the lawn of Dr. Dunton's house is a splendid Pecan hickory (*Carya olivæformis*), about 90 feet high; this tree was raised from a nut brought from Arkansas by Thomas Nuttall. A garden just opposite contains many remarkable plants. Through the courtesy of the owner, Miss Haines, we were allowed to wander through it. The house had a very English aspect, being clothed with ivy, *Jasminum nudiflorum*, honeysuckle, &c.; it was one of the first houses built in Germantown, and a former member of Miss Haines's family found the money to send Nuttall on his Arkansas trip. The garden looked very English, part of it being laid out in beds with box edging, and containing many old-fashioned herbaceous plants. A large standard tree of the "Seckel" pea, a variety which originated at Germantown, was 50 feet high, and laden with fruit. Myrtle, the prairie rose (*Rosa setigera*), phloxes, dahlias, sunflowers, fuchsias, &c. made a brave show. A very fine specimen of Kentucky coffee, 80 feet high, laden with its large pods, was a striking object. Very large tulip trees, pin oaks, sweet gum, and *Asimina triloba*, furnished abundant shade. A golden weeping box, 20 feet high, with a trunk 10 inches in diameter, was by far the finest specimen I had ever seen of this variety. A *Viburnum plicatum*, 15 feet high, was phenomenal; Professor Sargent had never seen so large a plant of this species. Large *Chimonanthus*, *Magnolias*, and *Philadelphus* were also noted.

Vernon Park, a small estate of eight acres, one of about a dozen and a half small parks which Mr. Meehan has been instrumental in adding to the park system of Philadelphia within the last 12 years or thereabouts, is a charming spot, and contains numerous remarkable trees. It contains a fine *Magnolia macrophylla*, the first plant brought into cultivation in America, and without exception the largest Papaw (*Asimina triloba*) I ever either saw or read of; from 10 to 20 feet are given as the limit of size in Gray's Manual; this is 40 feet high, with a stem 15 inches in diameter; it was bearing a good crop of fruit. Other noteworthy specimens were examples of *Cornus florida*, *Paulownia*, English yew, red oak, and tulip tree.

Germantown Cricket Club.—The finest specimen of the cucumber tree *Magnolia acuminata*, I have heard of is in the grounds of the above-mentioned institution; its stem has a girth of eight feet, and it is between 80 and 90 feet in height. A remarkable yellow wood *Cladrastis tinctoria*, probably brought on horseback by Audubon, and most likely the first of the species planted in America, is here; it is fenced round and evidently well cared for. Other noteworthy trees here are a very large *Larix americana*, a grand White Pine (*Pinus Strobus*), a large tulip tree, and a fine specimen of *Ilex opaca*.

The Hudson.—A trip was made up the Hudson to Poughkeepsie, whence a drive of a few miles brought us to Hyde Park, the residence of Mr. Walter Langdon. The grounds of Hyde Park are of considerable extent and present features of special interest; they were laid out by Parmentier during the earlier half of the present century. The original beauties of the situation have been emphasized by judicious clearings and skilful management. From the natural terrace near the house with a distant view of the Catskills, and to the north splendid river scenery, the eye ranges over wide stretches of turf bordered by noble trees. All who are interested in landscape gardening should see this place which is a practical object lesson showing how the foregrounds to such fine distances should be treated. "For a long time," says Downing in his "Landscape Gardening" "Hyde Park, was the finest " seat in America, but there are now many rivals to this claim." Parmentier's labours and example are considered by Downing to have effected, directly, far more for landscape gardening in America than those of any other individual whatever.

By a rocky stream there are large Hemlocks, and in the turf near I found naturalized an abundance of our Creeping Jenny (*Lysimachia Nummularia*. A blaze of *Rudbeckia hirta* by the border of a wood, lit up one of the vistas. Among the notable trees seen were large Chestnut Oak (*Quercus Prinos*), fine White Pines and Sugar Maples. One hill-side crowned by large Norway Spruce and White Pine, standing out boldly against the sky, was golden with native composites. A grove of beeches in another place contrasted with the sombre colour of the pines. A specimen of Ginkgo, with a stem 36 inches in diameter, was duly admired; also others of Purple Beech, *Halesia* *tetraptera* (the so-called Snowdrop tree), Tulip tree, Cucumber tree (*Magnolia accuminata*), Locust (*Robinia Pseudacacia*) which here was quite free from borers. Bass-wood, and a remarkable Pitch Pine (*Pinus rigida*) by far the finest I had ever seen.

The return to New York was made by rail. Masses of American Arborvitæ, *Juniperus virginiana*, *Cornus florida*, *Ailantus* (naturalized), *Pinus rigida*, &c., were noted along the banks of the river. Along the margins of the ponds the purple Loosestrife (*Lythrum Salicaria*) was in beautiful flower, in the water itself *Sagittaria variabilis* and *Nymphæa odorata*, produced a fine effect. Here and there a mass of the Cardinal flower (*Lobelia cardinalis*) with its large, intensely red blossoms, had taken possession of a plot of ground to the exclusion apparently of everything else In the dryer spots *Helianthus*, *Rudbeckia*, *Solidago nemoralis* and *Saponaria officinalis* (this last introduced from Europe and naturalized here) produced fine colour effects the third week in August when I saw them.

At Irvington, about a score miles from New York, is Sunnyside, the home of Washington Irving, half hidden by elms. The east end of the house is covered with ivy, grown from cuttings "given to Irving at " Abbotsford by Sir Walter Scott."

Rose growing under Glass.—In many places roses are cultivated very extensively under glass for the supply of cut flowers during winter. The houses of the most approved pattern are three-quarter span, the short span having a steep pitch to catch as much light as possible in winter. Beds, with narrow walks between, are raised on wooden supports, and in these, which are sometimes not more than four to six inches deep, are planted out in rows, young plants which have been raised from carefully selected cuttings and established in small pots; the distances vary according to the variety used, but on an average they are nine or ten inches from plant to plant and twelve or fourteen inches from row to row. Bone meal is often mixed with the soil and as soon as the plants begin to grow freely the surface is mulched. As a rule the plants are grown but a single season and after that they are thrown away, the old soil entirely removed and replaced by new in which young plants are again grown. Some growers try two or three varieties a second year, but this is not usual. The varieties most largely grown are the following, Pearl, Clothilde Soupert, Niphetos, Catherine Mermet, The Bride, Madame Hoste, Sunset, F. W. Bennett, and American Beauty. All these must be cut with long stems, a short-stemmed flower would not be accepted by the flower sellers. In a very large rose-growing establishment near Washington as many as 20,000 rose flowers have been cut in one day; from this place they are forwarded by mail all over the United States.

CCCLXI.—DIAGNOSES AFRICANÆ II.

CONVOLVULACEÆ.

Auctore J. G. Baker.

65. **Agyreia? macrocalyx,** *Baker;* dense argenteo-pubescens, foliis cordato-ovatis, pedunculo unifloro, calyce magno dense piloso sepalis biseriatis duobus exteriorbus orbicularibus, corolla calyce triplo longiori tubo sericeo, staminbus styloque flore duplo brevioribus.

Hab. — East Tropical Africa, 3°–7° S. lat.; Nesilala, *Bishop Hannington.*

Folia 7–8 poll. longa. *Calyx* 1½ poll. longus. *Corolla* 4–5 poll. longa. *Fructus* ignotus.

66. **Argyreia? laxiflora,** *Baker;* caulibus fruticosis, foliis cordato-orbicularibus facie glabrescentibus dorso dense pubescentibus, cymis plurifloris, pedunculo pedicellisque elongatis, calyce parvo leviter pubescenti sepalis orbicularibus subæqualibus, corolla calyce 6–8-plo longiori, staminibus flore duplo brevioribus.

Hab. East tropical Africa, Nyassaland, *Buchanan.*

Folia 6–8 poll. longa. *Sepala* 6 lin. longa. *Corolla* 3–4 poll. longa. *Fructus* ignotus.

67. **Agyreia? Grantii,** *Baker;* rhizomate magno globoso, caulibus suberectis, foliis cordato-ovatis subtus obscure pubescentibus, cymis densis multifloris, calyce dense pubescente, sepalis interioribus exterioribus brevioribus, corolla calyce 5–6-plo longiori, staminibus brevibus.

Hab.—East Tropical Africa, Chopeh, 2° N. lat., *Grant.*

Folia 6–8 poll. longa. *Sepala* 6 lin. longa. *Corolla* 3–4 poll longa. *Fructus* ignotus.

68. **Argyreia? Hanningtoni,** *Baker;* late volubilis, foliis cordato-ovatis dense argenteo-pubescentibus, calyce glabro biseriato, sepalis exterioribus ovatis interioribus occultantibus, corolla calyce 4–5-plo longiori, genitalibus flore duplo brevioribus.

Hab.—East Tropical Africa, between 3° and 7° S. lat., Kisokwe, *Bishop Hannington.*

Folia iis *A. macrocalycis* minora. *Sepala* pollicaria. *Corolla* 4–5 pollicaris. *Fructus* ignotus.

69. **Convolvulus angolensis,** *Baker;* perennis, caulibus patulis haud volubilibus pilosis, foliis subsessilibus parvis lanceolatis pilis adpressis albidis utrinque vestitis, floribus solitariis breviter pedunculatis, sepalis oblongis acutis sericeis, corolla alba calyce duplo longiori.

Hab.—Angola, Cuenza, *H. H. Johnston.*

Folia 3–6 lin. longa. *Sepala* 3 lin. longa. *Corolla* 6 lin. longa.

70. **Convolvulus Thomsoni,** *Baker;* volubilis, caulibus pilis brevibus patulis dense vestitis, foliis cordato-ovatis plicatis obscure crenatis utrinque dense pilosis, floribus solitariis breviter pedunculatis, sepalis ovatis acutis subæqualibus, corolla calyce sesquilongiori.

Hab.—Lower plateau, north of Lake Nyassa, *Joseph Thomson.*

Folia 9–12 lin. longa. *Sepala* 3 lin. longa.

Very near the Cape and Tropical African *C. sagittatus*, Thunb.

71. **Breweria conglomerata**, *Baker ;* perennis, herbacea, ramis dense pilosis, foliis sessilibus oblongis confertis utrinque dense pilosis, cymis unifloris vel paucifloris in foliorum axillis subsessilibus, sepalis ovatis acutis dense pilosis, corolla parvo, fructu globoso glabro.

Hab.—Angola, *Welwitsch*, 6160.

Folia 6–12 lin. longa. *Sepala* 1½ lin. longa.

72. **Breweria microcephala**, *Baker ;* perennis, herbacea, caulibus gracilibus dense pilosis, foliis subsessilibus oblongis vel lineari-oblongis obtusis utrinque dense hirsutis, cymis paucifloris glomeratis, sepalis lanceolatis acuminatis dense hirsutis, corolla minima, stylis ad basin bifidis, fructu globoso.

Hab.—Angola, *Welwitsch*, 6159.

Folia 6–12 lin. longa. *Sepala* 2 lin. longa.

73. **Breweria sessiliflora**, *Baker ;* perennis, herbacea, ramis patulis dense pilosis, foliis subsessilibus oblongis obtusis mucronatis utrinque dense pilosis, floribus 1–4 in axillis foliorum sessilibus, sepalis ovatis acuminatis, corolla calyce vix longiori, fructu globoso glabro.

Hab.—Zambesi valley between Senna and Lupata, *Kirk.*

Folia 5–6 lin. longa. *Sepala* 1¼ lin. longa.

74. **Breweria (Seddera) baccharoides**, *Baker ;* erecta, fruticosa, ramulis pilis adpressis albidis dense vestitis, foliis lineari-oblongis acutis basi cuneatis utrinque pilis hispidis albidis tenuiter vestitis, cymis unifloris vel paucifloris in axillis foliorum subsessilibus, sepalis ovato-acuminatis pilosis, corolla calyce duplo longiori, stylis basi connatis, fructu globoso.

Hab.—Zambesi valley between Tette and the coast, *Kirk.*

Folia 6–9 lin. longa. *Sepala* 2 lin. longa. *Fructus* 2 lin. diam.

75. **Breweria (Prevostea) campanulata**, *Baker ;* fruticosa, sarmentosa, ramulis pubescentibus, foliis petiolatis obovato-oblongis cuspidatis facie glabris dorso pubescentibus, cymis glomeratis sessilibus axillaribus, sepalis valde inæqualibus exterioribus orbicularibus demum magnis scariosis, corolla extus pubescenti, stylis ad medium coalitis.

Seddera campanulata, K. Schum. inedit.

Hab.—Sibange farm, Gaboon river, *Soyaux.*

Folia 3–5 poll. longa. *Sepala* exteriora demum 2 poll. lata. *Corolla* 15–18 lin. longa.

76. **Breweria (Prevostea) Heudelotii**, *Baker ;* fruticosa, sarmentosa, ramulis glabris, foliis petiolatis ovatis obtusis coriaceis utrinque glabris, cymis paucifloris axillaribus sessilibus, pedicellis brevibus pubescentibus medio bracteolatis, sepalis ovatis vel oblongis, corollæ tubo campanulato lobis ovatis, stylis apice solum bifidis.

Hab.—Senegambia, *Heudelot*, 864.

Folia 3–4 poll. longa. *Sepala* 2 lin. longa. *Corolla* 8–9 lin. longa.

77. **Breweria buddleoides,** *Baker;* fruticosa, sarmentosa, ramulis pilosis, foliis sessilibus oblongis subacutis mucronatis utrinque dense pilosis, cymis in paniculam terminalem dispositis, bracteis ovatis pilosis, sepalis ovatis acutis dense pilosis, corolla parva, stylis supra medium solum bifidis.

HAB.—Banks of the Rovuma river 30 miles inland, *Kirk.*

Folia 2–3 poll. longa. *Sepala* 2 lin. longa.

78. **Ipomœa (Orthipomœa) discolor,** *Baker*; fruticosa, erecta, ramulis dense albo tomentosis, foliis petiolatis oblongis obscure repandis facie glabris dorso persistenter albo-tomentosis, floribus solitariis breviter pedunculatis, sepalis oblongis obtusis tomentosis, corolla magna pallida extus glabra.

HAB.—Lake Tanganyika, *Carson*, 18.

Folia 3–4 poll. longa. *Sepala* 6 lin. longa. *Corolla* 3–4 poll. longa.

79. **Ipomœa (Orthipomœa) xiphosepala,** *Baker*; erecta caulibus pilosis, foliis subsessilibus oblongis acutis integris utrinque dense pilosis, floribus solitariis subsessilibus, sepalis oblongo-lanceolatis acuminatis pilis hispidulis vestitis, corolla calyce duplo longiori.

HAB.—Angola, *Welwitsch*, 6101.

Folia 6–9 lin. longa. *Sepala* 3 lin. longa. *Corolla* 6 lin. longa.

80. **Ipomœa (Orthipomœa) Elliottii,** *Baker;* erecta, caulibus albo-tomentosis, foliis petiolatis ovatis cordatis obtusis integris facie obscure stellato-pubescentibus dorso dense albo-tomentosis, floribus solitariis breviter pedunculatis, sepalis oblongis obtusis dense tomentosis, corolla rubella calyce 7–8-plo longiori.

HAB.—Matabele land, *Rev. W. Elliott.*

Folia 2–3 poll. longa. *Sepala* 6 lin. longa. *Corolla* 4 poll. longa.

81. **Ipomœa (Strophipomœa) phyllosepala,** *Baker;* sarmentosa, caulibus gracilibus pubescentibus, foliis petiolatis ovatis cordatis acutis vel obtusis integris utrinque dense pilosis, cymis paucifloris breviter pedunculatis, sepalis ovatis pilosis, corolla alba basi lilacina calyce 4-plo longiori extus pubescenti.

HAB.—Zambesi land, *Kirk.*

Folia 1½–2 poll. longa. *Sepala* 3 lin. longa. *Corolla* 1 poll. longa.

82. **Ipomœa (Strophipomœa) cephalantha,** *Baker;* sarmentosa, caulibus gracilibus dense pubescentibus, foliis breviter petiolatis integris ovatis cordatis utrinque dense pilosis, cymis multifloris glomeratis, sepalis oblongis mucronatis ciliatis, corolla lutea calyce duplo longiori.

HAB.—Mount Kilimanjaro, alt. 6,000 ft., *H. H. Johnston.*

Folia 1½–2 poll. longa. *Sepala* 4 lin. longa.

83. **Ipomœa (Strophipomœa) benguelensis,** *Baker;* sarmentosa, caulibus tenuiter pilosis, foliis petiolatis ovatis breviter trilobatis utrinque pilosis, cymis glomeratis pedunculatis, bracteis persistentibus foliaceis ovatis vel lanceolatis, sepalis ovatis pilosis, fructu globoso glabro, seminibus glabris.

HAB.—Angola, province of Benguela, *Welwitsch*, 6127.

Folia 1½–2 poll. longa et lata. *Sepala* 6 lin. longa. *Fructus* 3 lin. diam.

84. **Ipomœa (Strophipomœa) zambesiaca,** *Baker;* perennis, volubilis, caulibus gracilibus glabris, foliis ovatis vel lanceolatis basi cuneatis utrinque obscure pubescentibus, cymis 1–6-floris, pedunculo elongato, sepalis oblongis glabris, corolla albida calyce 8–9-plo longiori, fructu globoso glabro, seminibus glabris.

HAB.—Shupanga and the delta of the Zambesi, *Kirk*, *L. Scott.*

Folia 2–4 poll. longa. *Sepala* 2 lin. longa. *Corolla* 2 poll. longa. *Fructus* 3 lin. diam.

85. **Ipomœa (Strophipomœa) aspericaulis,** *Baker;* perennis, caulibus procumbentibus pilis hispidis asperis vestitis, foliis sessilibus lanceolatis integris subcoriaceis glabris, floribus solitariis, pedunculo brevissimo, sepalis ovatis acuminatis glabris, corolla rubra calyce 3–4-plo longiori.

HAB.—Angola, *Welwitsch,* 6120.

Folia 1½–2 poll. longa. *Sepala* 6 lin. longa. *Corolla* 1½–2 poll. longa.

86. **Ipomœa (Strophipomœa) Hanningtoni,** *Baker;* annua, caulibus volubilibus parce pilosis, foliis linearibus brevissime petiolatis utrinque obscure pilosis, floribus solitariis brevissime pedunculatis, sepalis ovatis obtusis dorso scabris, corolla pallide rubra calyce 8-plo longiori.

HAB.—East Tropical Africa, 3°–7° S. lat., *Bishop Hannington;* Tanganyika plateau, *Carson.*

Folia 2½–3 poll. longa. *Sepala* 2 lin. longa. *Corolla* 14–15 lin. longa.

87. **Ipomœa (Strophipomœa) Barteri,** *Baker;* annua, caulibus gracillimis volubilibus pilis subtilibus patulis vestitis, foliis brevissime petiolatis linearibus vel lanceolatis, floribus solitariis brevissime pedunculatis, sepalis ovatis obtusis pilosis, corolla calyce 6-plo longiori.

HAB.—On the Quorra near Juba, *Barter.*

Folia 2–2½ poll. longa. *Sepala* 4 lin. longa. *Corolla* 2 poll. longa.

88. **Ipomœa (Strophipomœa) huillensis,** *Baker;* caulibus procumbentibus dense pilosis, foliis brevissime petiolatis ovatis auriculis basalibus parvis utrinque dense pilosis, floribus solitariis pedunculatis, sepalis ovatis acutis dense pilosis, fructu globoso glabro, seminibus glabris.

HAB.—Angola, province of Huilla, alt. 3,800–5,500 ft., *Welwitsch,* 6131.

Folia 6–12 lin. longa. *Sepala* 4 lin. longa. *Fructus* 4 lin. diam.

89. **Ipomœa (Strophipomœa) vagans,** *Baker;* caulibus procumbentibus gracilibus pubescentibus, foliis breviter petiolatis oblongis integris breviter cordatis utrinque pubescentibus, cymis 1–3 floris, sepalis oblongis acutis, corolla parva, fructu globoso glabro.

HAB.—Nyassa land, *Buchanan.*

Folia 12–18 longa. *Sepala* 4 lin. longa. Near *I. sulphurea,* Hochst.

90. **Ipomœa (Strophipomœa) diplocalyx,** *Baker;* volubilis, caulibus pubescentibus, foliis breviter petiolatis ovatis breviter cordatis acutis utrinque pubescentibus, floribus solitariis pedunculatis, calyce biseriato sepalis exterioribus oblongis obtusis pubescentibus interioribus occultantibus, corolla calyce sesquilongiori extus glabra.

HAB.—Delta of the Zambesi, *L. Scott.*

Folia 1½–2 poll. longa. *Sepala* 9–12 lin. longa. *Corolla* 18 poll. longa.

91. **Ipomœa (Strophipomœa) Vogelii,** *Baker;* caulibus procumbentibus glabris, foliis petiolatis late ovatis obtusis breviter cordatis interdum emarginatis, cymis laxe multifloris, floribus omnino *I. asarifoliæ.*

HAB.—Kouka, Lake Tschad, *Dr. Vogel.*

Nearly allied to *I. asarifolia,* R. and S.

92. **Ipomœa (Strophipomœa) Carsoni,** *Baker;* volubilis, caulibus pubescentibus, foliis petiolatis cordato-ovatis integris subglabris, cymis laxis 6–8 floris pedunculatis, sepalis lanceolatis pilosis, corolla perparva, fructu globoso, seminibus glabris.

HAB.—Plateau above Lake Tanganyika, *Carson.*

Folia 2–3 poll. longa. *Sepala* 2 lin. longa. *Fructus* 5 lin. diam.

93. **Ipomœa (Strophipomœa) Morsoni,** *Baker;* annua, volubilis, caulibus gracillimis subglabris, foliis petiolatis cordato-ovatis glabris, floribus solitariis brevissime pedunculatis, sepalis ovatis acutis glabris, corolla alba calyce duplo longiori, fructu et seminibus glabris.

HAB.—Sierra Leone, *Morson.*

Folia 2–3 poll. longa. *Sepala,* 3 lin. longa. *Corolla* 6 lin. longa.

94. **Ipomœa (Strophipomœa) inconspicua,** *Baker;* annua, caulibus diffusis dense pubescentibus, foliis petiolatis cordato-ovatis utrinque dense pubescentibus, floribus solitariis pendunculatis, sepalis ovatis acutis dense pilosis, corolla perparva, fructu glabro, seminibus tenuiter pubescentibus.

HAB.—Nakulambe, Nyassaland, *Buchanan.*

Folia 12–18 lin. longa. *Sepala* 3 lin. longa. *Fructus* 4 lin. diam.

95. **Ipomœa (Strophipomœa) polytricha,** *Baker;* annua, volubilis, caulibus dense pilosis, foliis petiolatis, cymis pedunculatis 2–3 floris, sepalis lanceolatis dense pilosis, corolla calyce 5–6-plo longiori.

HAB.—Loanga, *Soyaux,* 83.

Folia 2-3 poll. longa. *Sepala* 4 lin. longa. *Corolla* 1¼ poll. longa.

96. **Ipomœa (Strophipomœa) oxyphylla,** *Baker;* volubilis, caulibus leviter pubescentibus, foliis petiolatis cordato-ovatis facie subglabris dorso tenuiter pubescentibus, cymis paucifloris, pedunculo longissimo, sepalis ovatis obtusis mucronatis pilosis, corolla calyce 4-plo longiori.

HAB.—Angola, *Welwitsch,* 6229.

Folia 3–4 poll. longa. *Sepala* 3 lin. onga. *Corolla* 1 poll. longa.

97. **Ipomœa (Strophipomœa) shirambensis,** *Baker ;* perennis, glabra, caulibus volubilibus fruticosis, foliis hysteranthiis ignotis, cymis paucifloris subsessilibus vel breviter pedunculatis, sepalis ovatis acutis, corolla alba fauce lilacina calyce 3–4-plo longiori.

HAB.—Shiramba, Zambesi-land, *Kirk.*

Sepala 4–6 lin. longa. *Corolla* 1½ poll. longa.

98. **Ipomœa (Strophipomœa) acuminata,** *Baker ;* volubilis, caulibus gracilibus pilis fragilibus patulis præditis, foliis petiolatis cordato-ovatis membranaceis utrinque pilosis, cymis paucifloris pedunculatis, sepalis ovatis acuminatis dense pilosis, corolla calyce 2–3-plo longiori.

HAB.—Zambesi highlands, alt. 2,000–4,000 ft., *Kirk.* Blantyre, Nyassaland, *Buchanan.*

Folia 1½–3 poll. longa. *Sepala* 4 lin. longa.

99. **Ipomœa (Strophipomœa) tambelensis,** *Baker ;* volubilis, caulibus fruticosis subtiliter pubescentibus, foliis petiolatis cordato-orbicularibus utrinque pubescentibus, cymis multifloris longe pedunculatis, sepalis lanceolatis acuminatis dense pilosis, corolla alba fauce purpurea calyce duplo longiori.

HAB.—Tambele, Upper Shiré Valley, *Kirk.*

Folia 3–4 poll. longa et lata. *Sepala* 6 lin. longa. *Corolla* 1 poll. longa.

100. **Ipomœa (Strophipomœa) megalochlamys,** *Baker ;* volubilis, caulibus fruticosis dense albo pubescentibus, foliis petiolatis orbicularibus breviter cordatis utrinque dense molliter pubescentibus, cymis paucifloris pedunculatis, sepalis oblongis obtusis dense pubescentibus, corolla calyce 2–3-plo longiori extus pubescenti.

HAB.—Angola, *Welwitsch*, 6113.

Folia 2–3 poll. longa. *Sepala* 8–9 lin. longa. *Corolla* 1½–2 poll. longa.

101. **Ipomœa (Strophipomœa) Holubii,** *Baker ;* fruticosa, volubilis caulibus dense albo-pubescentibus, foliis breviter petiolatis cordato-ovatis obtusis vel subacutis utrinque dense pubescentibus, cymis pedunculatis 1–3-floris, sepalis orbicularibus minute mucronatis dense pubescentibus, corolla rubra calyce 6–8-plo longiori.

HAB.—Leshumo valley, Zambesia, *Dr. Holub.*

Folia 1–2½ poll. longa et lata. *Sepala* 4 lin. longa. *Corolla* 2–3 poll. longa.
Near *I. Lindleyi*, Choisy.

102. **Ipomœa (Strophipomœa) nuda,** *Baker ;* caulibus fruticosis gracilibus glabris, foliis petiolatis cordato-ovatis acutis utrinque viridibus glabris, cymis dense multifloris pedunculatis, sepalis ovatis obtusis glabris, corolla calyce 4–5-plo longiori.

HAB.—Angola, *Welwitsch*, 6230.

Folia 3–4 poll. longa. *Sepala* 6 lin. longa. *Corolla* 2–2½ poll. longa.

103. **Ipomœa (Strophipomœa) shupangensis**, *Baker;* volubilis, caulibus fruticosis glabris, foliis longe petiolatis cordato-ovatis membranaceis glabris, cymis multifloris pedunculatis, sepalis ovatis obtusis glabris, corolla alba calyce 5–6-plo longiori.

Hab.—Zambesi valley between Tette and its mouth, *Kirk.*

Folia 3–4 poll. longa. *Sepala* 6 lin. longa. *Corolla* 2½–3 poll. longa.

104. **Ipomœa (Strophipomœa) Wakefieldii**, *Baker;* volubilis, caulibus fruticosis tenuiter pubescentibus, foliis cordato-ovatis subtus primum albo-reticulatis demum pubescentibus, cymis paucifloris breviter pedunculatis, sepalis oblongis obtusis tenuiter tomentosis, corolla calyce 6–8-plo longiori.

Hab. — Nyika country, South-East Tropical Africa, *Rev. T. Wakefield.*

Folia 5–6 poll. longa. *Sepala* 6 lin. longa. *Corolla* 3½ poll. longa.

Near the Cape *I. Gerrardi*, Hook in Bot. Mag. t. 5651 and *I. albovenia*, G. Don.

105. **Ipomœa (Strophipomœa) Buchanani**, *Baker;* volubilis, fruticosa, caulibus pubescentibus, foliis longe petiolatis cordato-ovatis utrinque pubescentibus, cymis paucifloris longe pedunculatis, sepalis orbicularibus pilosis, corolla rubra calyce 8–10-plo longiori.

Hab.—Nyassa-land, *Buchanan* (319 of 1883 collection).

Folia semipedalia. *Sepala* 4 lin. longa. *Corolla* 3 poll. longa.

Near *I. Lindleyi*, Choisy.

106. **Ipomœa (Strophipomœa) odontosepala**, *Baker;* volubilis, caulibus glabris, foliis glabris petiolatis orbicularibus profunde palmatis lobis 5 oblongo-lanceolatis acuminatis, cymis paucifloris, sepalis inæqualibus oblongis obtusis exterioribus brevioribus crenatis, corolla alba calyce 10–12-plo longiori.

Hab.—East Tropical Africa 2°–7° S. lat., *Bishop Hannington.*

Folia 1½–2 poll. diam. *Sepala* 4 lin. longa. *Corolla* 4 poll. longa.

Near *I. palmata*, Forsk.

107. **Ipomœa (Strophipomœa) stellaris**, *Baker;* perennis, glabra, caulibus procumbentibus, foliis petiolatis orbicularibus ad basin palmatis lobis 7 linearibus integris inferioribus furcatis, cymis multifloris pedunculatis, sepalis ovatis acutis glabris, corolla calyce 8–10-plo longiori.

Hab.—Banks of the Rovuma river, *Kirk.*

Folia 2–1 poll. longa. *Sepala* 2 lin. longa. *Corolla* 1½ poll. longa.

108. **Ipomœa (Aniseia) Smithii**, *Baker;* volubilis, caulibus glabris foliis petiolatis cordato-ovatis glabris, cymis 1–2-floris, sepalis ovatis glabris inæqualibus exterioribus demum cordatis, corolla calyce duplo longiori, fructu globoso glabro.

Hab.—Congo, *C. Smith.*

Folia 1½ poll. longa. *Sepala* 6 lin. longa. *Corolla* pollicaris.

109. **Ipomœa (Calonyction) shirensis**, *Baker*; volubilis, caulibus papillosis glabrescentibus, foliis petiolatis, cordato-ovatis ad venas primarias obscure ciliatis, cymis 2–4 floris longe pedunculatis, pedicellis fructiferis incrassatis, sepalis ovatis cuspidatis glabris, corolla alba calyce 10-plo longiori, tubo infra medium infundibulari, fructu globoso, seminibus glabris.

HAB.—Shiré highlands, *Kirk*, *Buchanan*.

Folia 3–5 poll. longa. *Sepala* 6 lin. longa. *Corolla* 5 poll. longa.

CCCLXII.—MISCELLANEOUS NOTES.

MR. WILLIAM TRUELOVE, late foreman of the Arboretum in the Royal Gardens, died at Brixton on Tuesday, January 16th, after a short illness. He retired from service at Kew in April 1892, when he was 70 years of age. (See *Kew Bulletin*, 1892, p. 185.)

Kew Bulletin.—The annual volumes for 1887, 1888, and 1889 being out of print, are no longer supplied to the public by H.M. Stationery Office.

Index Kewensis.—The second part of this work, completing the first volume, appeared in December. This brings the index down to the end of the genus *Justicia*, and forms a volume of 1,268 pages, containing about 200,000 names. Good progress is being made with the second volume, of which 200 pages are already in print.

Guide to Timber Museum.—A second edition of the "Official Guide to the Museums of Economic Botany (No. 3) Timbers" has just been issued. It has been carefully revised, and augmented to the extent of some 18 pages, the principal additions being the collections of woods from the Cape, Dominica, and Fiji, received from the Colonial and Indian Exhibition of 1886. The fine collection of New South Wales woods has been thoroughly overhauled, and the native and scientific names corrected and verified, a work which has received a considerable amount of assistance from Mr. J. H. Maiden, F.L.S., the energetic curator of the Technological Museum at Sydney.

Key Plan.—A new edition of the Key Plan, sold at the gates of the Royal Gardens, has been issued to the public. The details have been carefully revised, and brought up to date by the Surveyor's Department of H.M. Office of Works. Owing to an oversight on the part of the Stationery Office, the map has been issued of a size somewhat larger and less convenient for the pocket than the preceding edition.

Structural Improvements.—The following structural alterations and improvements were made in the plant-houses during the past year:—

Conservatory. (*No.* 4.)—This house was built in 1792 for "New Holland" plants. The wings were added in 1844–5 by Decimus Burton. The woodwork being decayed and the smallness of the panes of glass and antiquated arrangements for ventilation being in adequate for modern methods of cultivation, its re-construction on an improved plan was undertaken by H.M. Office of Works. The central portion was completed in 1892, exactly a century after its first erection, the wooden roof being replaced by an iron one of much lighter and more elegant appearance, and the sashes glazed with wider panes. A lantern ventilator was added. Last year the north wing was undertaken, made 2 feet wider, and the roof raised and a lantern ventilator added. This year it is hoped the south wing will be re-constructed. The house will then be larger, lighter, and in every way better fitted for the cultivation of choice greenhouse plants.

Cool Fern Pit. (No. 6A.)—The development of the collection of cool or greenhouse ferns which has taken place within the last five years, and for which the fine cool fern house (No. 3) was erected in 1892, created the need of a nursery pit for them. This was built last year in the yard adjoining the Ferneries. It is span-roofed, 44 feet by 10½ feet, and 8 feet high, and replaces some dilapidated frames.

Temperate House.—Slate staging over the pipes has now been substituted for the wood-trellis stage running all round this house, and the plants have since been found to thrive better. Bottom ventilators have also been placed in the wall at the north end for the benefit of the Himalayan Rhododendrons and of the collection of cool ferns which are planted at this end of the house.

Masdevallia Pit. (No. 16C.)—This has been re-constructed. It is now span-roofed and on a level with the adjoining ranges of private orchid pits.

Sarda Melon.—Dr. Aitchison, F.R.S., C.I.E., late Brigade-Surgeon, H.M. Bengal Army, has obtained from Kabul and sent to Kew two fruits of the celebrated Sarda melon. They arrived at the beginning of January, in excellent condition, carefully packed in cotton wool. The flesh, though firmer than that of the melons ordinarily cultivated in this country, amply justified in flavour the reputation which this fine fruit enjoys throughout India. There seems to be no reason why it should not be imported to this country in quantity for consumption during the winter. Dr. Aitchison had already, last year, sent to Kew, for the Museum, an excellent coloured plaster model of the fruit made for him at the Lahore School of Art. The following note gives fresh particulars as to its mode of cultivation.

EXTRACT from "Notes of Products of Western Afghanistan and North-eastern Persia," by Brigade-Surgeon J. E. T. Aitchison, pp. 48, 49.

Melons are largely cultivated as a field crop, but not to the same extent as the water melon. The variety *sarda* keeps well, and is exported to India in great quantity during the winter, where it is much appreciated by both Europeans and natives. Europeans in India and elsewhere have tried to raise from seed the *sarda* melon. This has always proved a failure, the fruit produced being of a very ordinary form, and never having the flavour of the Afghan fruit. The word *sarda* means cold, and subsequently came to mean the last fruits of the season left hanging on the trees when the main crop had been collected. The melon collected from the plants that yield the *sarda* whilst the season is hot and there is still no frost is, comparatively speaking, an ordinary good melon, but once the season is ending and night frosts have set in and the plants are beginning to be nipped, the gardeners carefully cover the fruit to prevent it from being injured by the frosts, and then collect it when not quite ripe; these fruits ripen very slowly, will keep through the whole winter, and in flavour seem to improve the longer they are kept. It is this treatment, I believe, that constitutes the difference between the ordinary melon and the *sarda*, and why gardeners out of Afghanistan and Persia have not been able to produce the fine-flavoured Peshawur trade article, and which, even in the old caravan, now railway, days, were carried in perfection to Southern India.

Seeds of the Sarda melon have been distributed to several Colonial Botanic Gardens and to the principal private gardens in this country, where melon cultivation is made a speciality.

Portrait of Samuel Frederick Gray.—Mr. Samuel Octavus Gray, the grandson of the nominal author of that remarkable book: " A Natural Arrangement of British Plants " (1821), has presented to the collection of portraits of botanists at Kew, an excellent picture in oils of his grandfather, Samuel Frederick Gray, the father of John Edward Gray and of George Robert Gray, who were respectively keeper and assistant keeper of the Zoological Department of the British Museum. He was one of a still unbroken line of botanists and zoologists, whose relationships, however, have been somewhat confused. The subject of the portrait, Samuel Frederick Gray, the son of Samuel Gray, a seedsman and importer of flower-roots of Pall Mall, was born in 1766 and died in 1828. He was from infancy and throughout his life of a delicate constitution; and after breaking down in an attempt to qualify himself for the medical profession, he resolved to devote himself to scientific research and literature. For a time he assisted Dr. Nares in editing a scientific review, and in 1797 he migrated to Walsall, and was associated with Dr. Black as a chemist and assayer of metals. He there became intimate with Dr. Priestly, whom he assisted in his chemical experiments. In the year 1800 he returned to London, and was engaged in various scientific pursuits, until 1806, when, on the death of his uncle Edward Whitaker Gray, for some time secretary of the Royal Society and keeper of the Natural History Department of the British Museum, who arranged the collections on the Linnean system, he removed to Chelsea, where he occupied himself in lecturing on scientific subjects, and assisted William Curtis, the author of the *Flora Londinensis* and the founder of the Botanical Magazine and his partner and successor, William Salisbury in their botanical work. It was here too, that he was engaged on his more important works,—" A Supplement to the Pharmacopœia," &c., and " A Natural Arrangement of British Plants." The latter, a work that had apparently been begun by his father, and in which he was subsequently assisted by his sons, Samuel Forfeit Gray, (father of Samuel Octavus Gray) and John Edward Gray. The latter, it may be added, has put it on record that he himself was practically the author of the work. Samuel Frederick's last work, published within a few weeks of his death and written when he was suffering from severe illness, is entitled "The Operative Chemist: A practical display of the Arts and Manufactures which depend on Chemical Principles," a second edition of which was published posthumously in 1831. The question of the authorship of the "Natural Arrangement of British Plants," is of great interest, inasmuch as it is a book that was far in advance of its time, and was practically ignored by the leading botanists of the day, who were largely prejudiced followers of Linnæus's Sexual system. It seems therefore desirable to print in full the following particulars collected by Mr. S. O. Gray.

"In this connexion I may answer your question as to Dr. J. E. Gray being mainly the author of the 'Natural Arrangement of British Plants.' I am aware that in '*Men of the Time*,' edition 1862, there is a statement which I know was inserted on my uncle's authority that in 1821 he [Dr. J. E. Gray] published under his father's name the 'Natural Arrangement of British Plants.' I am of opinion that this is an unfair statement of the part he took in this work, and I believe that the account I have already given is more nearly in accordance with the facts of the case. I have frequently conversed with my father on the subject of this book, and he always spoke of it as the work of his father, in which both he and my uncle assisted. In confirmation of this view, I may mention that the copy of the work that I have, and which formerly belonged to my father, is apparently composed of final proof-sheets, which are corrected throughout for the most part in the handwriting of my father, but occasionally in that of my grandfather. In further confirmation, I may add that a collection of British Plants, which from the dates of the specimens was evidently made during my grandfather's lifetime, and was arranged according to the natural system, was named in the handwriting of my father and grandfather, but in no instance that I can remember in that of my uncle. Again, though I was constantly with my uncle from my early childhood, I do not remember to have seen any collection of British plants belonging to him. He had a large collection of shells, and at the time I first remember him he appeared to have devoted himself chiefly to the study of conchology. I have two letters from a Mons. A. Abedoffsky, apparently a botanist travelling on the Continent, which though they do not specifically refer to the 'Natural Arrangement of British Plants,' allude chiefly to botanical studies in which the writer had been associated with my grandfather and his two sons. Both letters are addressed to my father at Apothecaries Hall, the first, dated Paris, 6th December 1817, consists of three letters, one addressed to my uncle, one to my father, and one to my grandfather, all three being on one sheet of paper; the second, dated Bern, 2nd January 1818, is apparently written solely to my father. I think these letters confirm, as far as they go, the view taken above that the work was a joint production, and in view of the fact that at the time of its *publication* my father was but 23 and my uncle but 21, I think it is a fair inference that my grandfather must have been responsible for the arrangement and all the more important features of the work, and is consequently entitled to the principal share of any honour that the book may be thought to deserve."

In explanation of the statement that Samuel Frederick Gray was one of a still unbroken line of naturalists, it may be added that the donor of the portrait is himself the author of an excellent popular work on British seaweeds, though his walk in life has been only to a very small extent on the seashore. His son, John Edward Gray, has highly distinguished himself both in botany and zoology, both at University College, London, and at Cambridge. And the first Samuel Gray, the grandfather of the subject of the portrait, born in 1694, was, like his son, a seedsman and importer of flowers and roots in Pall Mall.

Borers of Jarrah Timber.—Mr. W. H. Blandford has furnished the following note of his further examination of the specimens discussed in a previous number of the *Kew Bulletin* (1893, pp. 338, 339).

"The broken specimens of a boring insect sent with the accompanying piece of Karri wood have been further examined since my last communication.

"They belong not to one, but to at least two individuals of different sizes, and are referable to the exclusively Australian genus of Longicorn beetles, *Phoracantha*, Newm. They form part of the sub-family *Cerambycidæ*, not the *Prionidæ*, as I stated in my first letter, but the difference is not important except to a zoologist. The species is doubtful, it is probably *P. synonyma*, Newm. (= *punctata*, Kirby).

"They are variable insects and not easy of determination. As they are exclusively Australian, they are not likely to damage Karri timber after it is exported, except that they may subsequently reach maturity in the logs.

"(Signed) W. F. H. Blandford.

"January 15, 1894."

Portrait of Professor Oliver.—An excellent portrait of Professor Oliver, F.R.S., the late keeper of the Herbarium and Library of the Royal Gardens, has been painted by Mr. J. Wilson Forster (who also painted the portrait of the present keeper, Mr. J. E. Baker, F.R.S., exhibited at the Royal Academy in 1893). Professor Oliver's portrait was commissioned by a number of his scientific and other friends, who have presented it to the Herbarium of the Royal Gardens, the scene of his labours from 1858 to 1890. Amongst them may be mentioned :—Professor Balfour, F.R.S. ; Professor Bower, F.R.S. ; C. B. Clarke, Esq., F.R.S. ; F. Du Cane Godman, Esq., F.R.S. ; Dr. Hogg, F.L.S. Sir Joseph Hooker, K.C.I.E. ; Dr. King, C.I.E., F.R.S. ; Right Hon. Sir John Lubbock, Bart, F.R.S. ; Dr. Masters, F.R.S. ; Dr. Scott, F.L.S. ; Right Hon. James Stansfeld ; Professor Traill, F.R.S. ; H. J. Veitch, Esq., F.L.S. ; Professor Vines, F.R.S., &c.

Pepper.—With reference to the difficulty experienced in the cultivation of pepper in the West Indies, Mr. H. N. Ridley, F.L.S., has been good enough to supply the following note :—

Extract from Letter from Director, Gardens and Forest Department, Straits Settlements, to Royal Gardens, Kew, Singapore, December 11, 1893.

Mr. Derry, I see, does not mention "*turning down*" in pepper cultivation, which I press on all planters. When the pepper gets to the top of the post you must make it bend down to the bottom, and start up again. Three times must this be done before the pepper is expected to fruit heavily, otherwise it is skinny and wretched. I don't know why it won't fruit in Jamaica, but I expect I should if I saw it.

The difficulty, however, appears to have been overcome in Trinidad:—

SUPERINTENDENT, ROYAL BOTANIC GARDENS, TRINIDAD, to ROYAL GARDENS, KEW.

Royal Botanic Gardens, Trinidad,
January 9th, 1894.

SIR,

I BEG to report that our vines of ***Piper nigrum*** have this year given a good crop. I send you a sample for the Economic Museum, which has been grown by Mr. C. W. Meaden, of the Prison Department at the Convict Depôt, from plants supplied by this department. There appears to be every prospect that "black pepper" can be successfully grown in Trinidad, as Mr. Meaden has harvested a crop of some 200 lbs., some trees bearing as much as two pounds each. Our own crop is not yet ripe. We should be thankful for a report on this sample.

I am, &c.,
(Signed) J. H. HART,
Superintendent.

The Director, Royal Gardens, Kew.

MESSRS. W. & D. HARVEST to ROYAL GARDENS, KEW.

Dowgate Dock, Upper Thames Street, London, E.C.
January 30, 1894.

DEAR SIR,

THE sample of black pepper grown in Trinidad, which you have sent us, is a good merchantable article. It is clean and bold, and resembles the better qualities of Tellicherry black pepper, except that it has rather more husk or outer skin. The market value in Mincing Lane would be about 2⅜*d.* to 2½*d.* per lb. This is an extremely low price for black pepper of good quality, free from dust, but the market is now depressed beyond former precedent by the very large stocks held in Europe, and by what appears to be about an unlimited production in the Straits Settlements. It is not very long since that pepper of this quality would have readily fetched in public sales from 5*d.* to 5½*d.* per lb.

We remain, &c.
(Signed) W. & D. HARVEST.

John R. Jackson, Esq.

Coffea sp., Sierra Leone.—Last year plants were distributed from Kew under this name to most of the Colonial and Indian Gardens. They were raised from seeds collected in Sierra Leone by Mr. Scott-Elliot, when attached to the Commission for the Delimitation of the Anglo-French frontier in 1892, and subsequently identified by him as a species of *Coffea*. The curator of the Botanical Station, Dominica, inquires if they are likely to be *C. stenophylla*, mentioned by Mr. Scott-Elliot in his notes on the Economic Plants of Sierra Leone (*Kew Bulletin*, 1893, p. 167), which appears to be preferred to the Liberian Coffee by French traders. On comparing plants at Kew, it is evident that it has nothing to do with *C. stenophylla*, G. Don, but has spines which *Coffea* never has, and is more likley to be a *Randia* or *Canthium*.

Botanic Station, St. Vincent.—In the last quarterly report on the Botanic Station, St. Vincent (July–September 1893), the Curator, Mr. Henry Powell, gives the following interesting particulars respecting the propagation of economic plants and their distribution in the island :—

"It is specially pleasing to me to be able to report the marked increased attention given to the planting of such plants as Cocoa, Nutmegs, Coffee, Black Pepper, &c. in this Colony. In most instances, planters raise their own plants, but from the Botanical Station alone upwards of 2,000 plants, chiefly consisting of the kinds named above, were distributed during the quarter ; of this number 1,099 were distributed (free) to peasant buyers of Crown lands. [Since the 30th September up to the time of writing this report, an additional 3,000 plants have been distributed in the Colony.]

"In the near future, judging from the present rate of planting, it is, perhaps, not too much to predict that St. Vincent will become a rival to Grenada as a cocoa and spice-producing island.

"The coffee plants raised from seeds received from Jamaica during the last quarter are doing well ; the most forward plants are being disposed of at 1*s*. 8*d*. per 100. A fair stock of Cocoa of the Forastero and Criollo varieties is also available for distribution. Plants of the above, in bamboo pots are charged for at the rate of 3*s*. 4*d*. per 100. With a view to lessening the difficulty of transit, a large number of cocoa plants have been raised in seed beds, from whence they are carefully taken up in bundles of from 15 to 20 plants, and wrapped round with tannia or other broad leaves ; this ensures their safe transit to almost any part of this Colony. Of course, the plants are best planted out during showery weather, and should be shaded for a few days from hot suns. If the above precautions are attended to, few, if any, of the plants will fail to grow. Cocoa plants taken from the seed beds are charged for at the rate of 1*s*, 8*d*. per 100."

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 87.] MARCH. [1894.

CCCLXIII.—SUGAR-CANE DISEASE IN OLD WORLD.

The following correspondence relates to a disease which has recently made its appearance amongst sugar-canes in Mauritius. The specimens sent to Kew from the Colony proved that it was undoubtedly due to the same fungus, *Trichosphæria sacchari* (in its most characteristic form), which, as shown in the *Kew Bulletin* (1893, pp. 149–152), has for some years past done great mischief in the West Indies.

Mr. Massee, Principal Assistant (*Cryptogams*) in the Herbarium of the Royal Gardens, has published in the "Annals of Botany" for December last (pp. 515-532) an exhaustive account, with detailed illustrations, of all that he has been able to ascertain with regard to this destructive pest.

DIRECTOR OF FORESTS AND GARDENS, MAURITIUS, to ROYAL GARDENS, KEW.

I HAVE sent to you by same mail which carries this letter a case containing a quantity of sugar-canes taken from one pit, and which are supposed to be suffering from some kind or form of disease. Following a conversation which I had with the Honourable Judge Rouillard (who authorises me to use his name), co-proprietor of St. Antoine estate, situated in the district of Riviére du Rempart, on the subject of cane disease, he, at my request, sent me the canes which are now forwarded to you. The disease, by what I have seen, appears to attack different patches in the field, and, although the foliage appears healthy, the body of the cane is attacked near to the nodes with what appears to be a disease of a fungoid nature, indicated on the surface of the cane by red blotches. Where these exist the under surface of the cane becomes dry and spongy, but does not, as far as I have been able to ascertain as yet, affect the growth of the cane. The main feature of the disease appears to be that it retards crystallization of the juice to a very marked degree when it reaches the boilers, and even the sugar produced falls short of what might be expected. The canes which I send are known here by the name of "Mapou perlé"; but I am informed that one of our best canes, "Louisir," is also attacked. I shall, therefore, be glad if you can in any way throw light on the matter, and render us

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assistance in keeping the disease in check. I shall keep you posted up with any new occurrence or observation on the subject.

I have, &c.
(Signed) WILLIAM SCOTT.

November 11th, 1893.

ROYAL GARDENS, KEW, to COLONIAL OFFICE.

SIR, Royal Gardens, Kew, January 5, 1894.

I HAVE the honour to inform you that I have received a communication from the Director of Forests and Gardens, Mauritius, respecting a disease which has made its appearance amongst the sugar-canes in that Colony, and advising the despatch of specimens.

2. These have reached Kew within the last few days and have been at once examined. The disease proves to be due unmistakeably to a fungus, and it is remarkable that this is identical with the *Trichosphæria sacchari*, which has recently made its appearance in the West Indies, and has already done no inconsiderable amount of damage there. It appears to me not improbable that it has been introduced thence into Mauritius.

3. A preliminary account of the disease was given in the *Kew Bulletin* for July last, of which I enclose a copy. I further enclose a copy of a detailed account of the fungus, which has been prepared from West Indian material by Mr. George Massee, a Principal Assistant in the Herbarium of the Royal Gardens.

4. Mr. Massee has drawn up a brief memorandum of advice as to the best action to be taken under the circumstances. A copy is enclosed, and this, with the documents above-mentioned, the Secretary of State will probably think it advisable to transmit to the Government of Mauritius for general information.

I am, &c.
(Signed) W. T. THISELTON-DYER.

Hon. Sir Robert Meade, K.C.B.,
Colonial Office,
Downing Street, S.W.

SUGAR-CANE DISEASE, MAURITIUS.

The canes are attacked by a fungus, *Trichosphæria sacchari*, identical with the fungus at present causing such havoc in sugar-cane plantations in the West Indies.

To prevent the spread of the disease it is necessary to resort to drastic measures. Burn every cane showing a trace of the disease first indicated externally by the appearance of numerous minute, upraised points just above the nodes towards the base of the cane; from these points proceed black, sticky masses, resembling a slight sprinkling of soot on the surface of the cane; these are the spores of the *Melanconium* stage of the fungus, which are soon dispersed by wind and rain, and in turn infect new areas. Prompt action alone can save the planter from being overpowered by the fungus, and as it is impossible to protect canes from its attack so long as the spores are being liberated, the only safe resource is to burn every trace of diseased cane.

The utmost care should be taken not to spread the disease by using canes for propagation from infected areas.

Aim at producing a *fungus-proof variety* of cane by propagating from those canes that remain unattacked when growing in an infected district.

G. M.

January 2, 1894.

Mr Massee has since been able to identify the disease with one which exists in Australia and which has been described with ability by Dr. Cobb, Pathologist to the Department of Agriculture, New South Wales. In the following note he has furnished a comprehensive review of our present scientific knowledge of the fungus producing it :—

In Dr. Cobb's report on "Diseases of the Sugar-cane" in the Clarence River district, New South Wales (*Agricultural Gazette of New South Wales,* October 1893) a widespread disease is described, and said to be caused by a fungus called *Strumella sacchari*, Cooke, originally described from Queensland. This proves to be identical with the disease caused by *Trichosphæria sacchari,* Mass., to which attention was first called from the West Indies (*Kew Bulletin*, 1893, pp. 149–152). It has since been identified in Mauritius; and now that its presence has been demonstrated in Australia, and also in North-West India, as proved by its presence on a specimen of *Saccharum officinarum* from Saharanpur, received in 1892, it is perhaps not too much to assume that this disease is present, in greater or less abundance, wherever the sugar-cane is cultivated.

In common with many Sphæriaceous fungi, *Trichosphæria* presents itself under more than one form during the completion of its life-cycle; four distinct phases are known, and the fact of these being very different from each other in general appearance accounts for the different names this fungus has received. Of these stages the *Melanconium* condition is best known ; being the conidial form destined for the rapid reproduction and dissemination of the species, it is most widely diffused, and also most conspicuous, on account of the enormous quantities of conidia or reproductive bodies that are being constantly liberated in the form of slender, curled black threads, which ooze out of the affected canes, and form a black mass on the surface. The disease is caused by this phase of the fungus. The two remaining conidial forms, as well as the highest or ascigerous condition, are only developed when the cane is thoroughly rotten, and consequently have escaped the attention of the planter, or they may only be developed at rare and irregular intervals, as it is known that the *Melanconium* stage can reproduce itself continuously, without the intervention of any other form.

It is somewhat remarkable that so conspicuous a fungus has, from the purely scientific side, escaped attention up to within the last three or four years, yet such appears to be the case, and its cosmopolitan distribution appears to be most readily explained by supposing it to have been imported along with its host, the sugar-cane.

The true native country of the *Trichosphæria* seems to be uncertain, but what little evidence there is points to an Eastern origin. On examining the numerous specimens of *Saccharum officinarum* in the Kew herbarium, traces of the *Trichosphæria* were noted on specimens from India and Borneo, received many years ago, whereas the material at command showed no sign of its presence in the New World previous to the sudden outbreak in the West Indies.

The following is a complete diagnosis of the fungus, also its synonymy and known distribution.

Trichosphæria sacchari, *Mass.*, *Ann. Bot.*, vol. vii., p. 515, pl. xxvii.

Fungus ascophorus. Peritheciis ovatis obtusis nigris, setulis filiformibus septatis acuminatis rigidis brunneis sursum pallidioribus undique vestitis, ascis cylindraceis apice rotundatis stipitatis octosporis, sporis oblique monostichis elliptico-oblongis hyalinis 8—9 × 4μ.

Fungus stylosporiferus (Melanconium *stage*). Acervulis nigris gregariis epidermide cinctis, conidiis cylindraceis utrinque obtusis brunneis continuis vel subinde pseudo-1-septatis 14—15 × 3·5—4μ in cirros gelatinosos varios nigros exsilientibus.

Strumella Sacchari, *Cooke*, *Grevillea*, vol. xix., p. 45 (1890); *Cobb*, *Agricultural Gazette of New South Wales*, vol. iv., pt. 10, p. 800, figs. 17–19.

Trullula sacchari, *Ellis and Everhart*, *Journ. Inst. of Jamaica*, vol. i., p. 159 (1892).

Fungus macroconidiophorus. Maculas effusas velutino-nigras, irregulares efformans, conidiis in interiore hypharum catenulatim formatis et dein exsilientibus ellipsoideis utrinque truncatis continuis brunneis 18—20 × 12μ.

Fungus microconidiophorus. Statui macroconidiophoro similis conidiis 10—11 × 6μ.

Hab. In culmis *Sacchari officinarum*.
Distr. India, Borneo, Mauritius, Queensland, New South Wales, West Indies.

Evidence has now come to hand which points to the existence of the same disease in Java.

Dr. Went has just described in the *Mededeelingen van het Proefstation West Java*, 1893, what he considers to be a new sugar-cane disease, caused by a fungus, to which he has given the name *Thielaviopsis ethaceticus*. When developing in a solution of sugar-cane sap, this fungus possesses the property of inducing alcoholic fermentation. The same, or a closely allied form, has previously been observed to cause a similar fermentation in pine-apple sap, hence the author calls the present disease, "pine-apple disease of the sugar-cane."

Judging from the description and figures, *Thielaviopsis* appears to be identical with the macro- and microconidial state of *Trichosphæria sacchari;* curiously enough the author has applied the above terms to the two conditions of his fungus, and apparently considers it as a stage only of some higher development, as he queries the constant absence of an ascigerous stage.

CCCLXIV.—SEMINAL VARIATION IN THE SUGAR-CANE.

The *Kew Bulletin* for 1891 (pp. 10–24) contained a discussion of the interesting discovery made at the Botanical Station (Dodd's Reformatory), Barbados, of the production of fertile seed by the sugar-cane, a function which it had long been supposed to have lost under cultivation.

From the well-known principle of seminal variation, it was obvious that a new method was open to the planter of obtaining fresh races of the sugar-cane. The procedure would, however, be slow, and would resemble that adopted in the case of "pedigree wheat." The plan would, in fact, consist of "selecting" in the seedlings of each generation those which presented, in some marked degree, one or more desirable characters. Each successive step in advance would in some individuals be cumulative, and at last a new race would be obtained, which could be propagated by cuttings in the ordinary way. A new race, possessing valuable qualities, might even, with great good fortune, to judge from the experience of other cultivated plants, emerge from the seed bed, as it were, *per saltum*. But this cannot be reckoned upon, and the best results will doubtless be attained in the long run by gradual and progressive selection.

The matter was at once taken in hand in Demerara, and the *Kew Bulletin* for 1891 (pp. 20–23) gave an interesting account of the earliest results obtained. For further study of the subject, reference may be made to the excellent "Report on the Agricultural Work in the Botanical Gardens, 1890 (Demerara, 1891)," by Mr. J. B. Harrison, the Government Analytical Chemist, and Mr. G. S. Jenman, the Government Botanist.

The following account, which is extracted from the *Sugar Cane* for January 1894 (pp. 19–20), shows what has in the meantime been accomplished in Mauritius. It describes the show of sugar-canes brought together at the Agricultural Exhibition of October 1893 :—

"The collection of sugar-canes was probably one of the best, if not the best, which has ever been brought together in one room in any part of the world. Not only could the visitor examine at his ease some 70 varieties, more or less established in the Colony, but the magnificent display of seedling canes and their produce, exhibited by the Mauritius Estates and Assets Company, presented an unrivalled opportunity of observing the cane in every stage of development, from the tiny seedling of an inch high to second ratoons from parent stock raised from seed. The history of the first successful attempt to raise sugar cane from native seed in this Colony is too well known to need repetition; but certainly, when the President of the Chamber of Agriculture announced to his colleagues in 1891 that the four great sugar companies had combined to offer a prize of Rs. 1,000 for the best collection of canes raised from indigenous seed (Sir Charles Lees having already procured some seed from Barbados), no one could have anticipated the splendid success of Mr. Perromat, Mr. Chalain, Mr. Kœnig, and others; or that in the short space of two years, thanks to the energy and foresight of Mr. Hay, such a collection of matured canes could have been submitted to public inspection. Such an event is full of good augury to the Colony; the fact, so long denied, that canes can be propagated from seed, has been finally established beyond all doubt in Barbados and Demerara, as well as in Mauritius, where acres of land, to be extended this year to hundreds of acres, are already planted with canes propagated directly from seed or from cuttings from seedlings. As might be expected, almost endless sports and varieties have been produced, some of which show tendencies to throw back on inferior types, but most of which are of a highly promising character. The most remarkable feature about them is their extreme robustness, many having 12 feet clear of cane, well grown, with long healthy internodes, while to find from 25 to 35 canes in one stool is by no means uncommon. The first ratoons have been found to be equally prolific. We are informed that canes have been propagated this year from *seeds of seedlings;* a strong evidence in favour of the permanence of the type produced. Amongst the specimens exhibited by Mr. Hay we counted 26 well-defined varieties; we believe that all were produced from seeds of Port Mackay, Lousier, Penang, and Bamboo; but the prevailing characteristics of the majority were certainly those of the Bamboo, which, from other analogies, we suspect to be the primitive stock of many of our varieties of purple canes. We must hope that the importance of the success achieved by those gentlemen who have raised canes from seed will not be lost sight of by planters at large. It is mortifying to find that after two years' familiarity with the fact, so few managers have taken the trouble to do what we now know can be done. The deterioration of the sugar cane is a favourite topic of conversation in our island; fabulous yields are spoken of in the good old days when Triple-Effets were not, and planters weighed not their canes; and many a head is wagged wisely over the urgent need of the introduction of new species of cane, and the great advantage to be gained if, by propagating from seed, healthy hybrids could be obtained; and yet how many of our planters have made the attempt?"

CCCLXV.—IMPROVEMENT OF SUGAR-CANE BY CHEMICAL SELECTION OF SEED CANES.

During the last ten years considerable attention has been devoted to the possible improvement of the sugar-cane as an industrial plant. The earlier steps taken were in the direction of introducing new sorts from the East Indies and the islands of the Pacific, in the hope that some at least of these would be found to possess greater vigour, yield larger crops, or be individually richer in saccharine properties. Some good was undoubtedly done in this way. Many new canes of merit were added to the few hitherto almost exclusively grown in sugar-producing countries. A larger range of selection was afforded to the planter who had to contend with special circumstances, such as the nature of the soil, season, elevation, and the amount and distribution of the rainfall. Where at one time only two or three sorts of canes were available for experimental cultivation, there are now more than a hundred named sorts. All this has undoubtedly had its influence on the industry, and in the hands of intelligent and observant men it has in some localities greatly improved the general yield and quality of the sugar. The utilisation of the chance varieties of sugar-canes that had arisen either from bud variation or fertile seed in various parts of the world was not, however, the most skilful nor perhaps the most economical way of seeking to improve sugar cultivation. It had long been thought that the sugar-cane had lost the power of producing fertile seed, and hence the possibility of improving the sugar-cane by cross fertilisation and selection had up to very recent times been abandoned. This has, however, proved in some measure not to be the case. The *Kew Bulletin* for January 1891, as well as the present number, contains some account of what has been done in attempting to take advantage of seminal variation. The net results of the experiments to improve the sugar-cane by this means cannot yet be determined. Although some canes of undoubted merit have been produced, the process in actual practice is one involving great labour and risk; for after growing thousands of seedling canes to maturity, it is possible that not one will possess properties at all superior to those already under cultivation. The opinion has always been held at Kew that in the long run the best results may be obtained by continuous propagation from selected canes.

The most ready means, and the one hitherto universally adopted, for propagating the sugar-cane is by cuttings. Sometimes the whole cane is planted, sometimes only short pieces or cuttings near the top, each bearing a few buds. In this way the same identical variety of cane is reproduced; but amongst a large number of canes thus propagated there will always appear some canes distinguished by increased size and prolificness, and capable at the same time of yielding a larger per-centage of sugar. Such exceptional canes are the result of what is called bud variation; and if these are carefully selected, and the process continually repeated, a variety will be eventually established superior to any canes of the sort from which it was originally derived. This method of procedure was suggested from Kew about seven years ago, but it is only within the last two years that it has been practically tested under scientific supervision.

A letter from Kew, addressed to the Colonial Office, dated May 12th, 1886, was summarised by it as follows :—" Mr. Thiselton-Dyer deems it " advisable to direct the attention, not only of professed botanists, but " also of planters, to the fact that new varieties (or sports) in sugar-canes " are to be sought in bud variation appearing accidentally in the cane " fields, and that when such bud varieties are noticed, stock plants " should be raised and carefully experimented upon until their value is " fully known." This paragraph was communicated by the Secretary of State for the Colonies to the Governments of West India Islands and to other Colonies where sugar-growing is a staple industry, and it was published locally in the Government Gazettes. It was not intended to confine attention merely to canes growing experimentally at Botanical gardens. The idea was to stimulate inquiry and observation throughout the cane fields of the whole of our tropical possessions. In the concluding paragraph of the letter above mentioned this was pointed out :— " For this purpose an area of one hundred acres is hardly more valuable " than one acre. It requires observation carried on over thousands of " acres of cane fields, together with the intelligent co-operation of all " interested in the subject."

It is not necessary to enlarge on the theoretical grounds for undertaking an enterprise of this kind. The facts already obtained in a series of experiments carried on at Calumet Plantation, Louisiana, have practically established the possibility of selecting canes in the field remarkable for size, prolificness, early maturity, and high saccharine quality, and of producing from these selected canes a succession of canes possessing similar qualities. The peculiarity of these experiments is that the selection has been based upon and controlled by chemical tests. If, by adopting this method, the average quality of the canes over a large area were uniformly raised, it is shown by the Louisiana experiments that for a crop of, say, 25,000 tons there would be added to it 180,000 pounds of sugar. This, however, is the result of one year's selection only. But in addition to the increased yield in sugar there is still another possible gain in the increased purity of the sugar. This is a more difficult matter to estimate, but it is a factor which adds to the potential value of the experiment.

By the courtesy of Mr. Wibray J. Thompson, of Calumet Plantation, Patterson, La., we are placed in possession of the results of the very interesting experiments carried on by him, with the aid of Mr. Hubert Edson, who undertook the chemical work, during the seasons of 1890, 1891, and 1892. This information is contained in a pamphlet (*Bulletin* No. 8) issued privately by the proprietor, Mr. Daniel Thompson. The most interesting part of the pamphlet is contained in pages 26–39, relating to the improvement of the sugar-cane by means of a selection controlled by chemical examination of the plant canes. In the pamphlet this selection is described as a "seed" selection. "Seed canes" in many sugar countries is an expression in use for the "cuttings" of canes, or for the canes themselves used for planting purposes. In most countries the tops of the canes comprising a few joints are used. In the Southern United States the "seed canes" consist of the whole canes laid in trenches and covered over like so many drain-pipes. Sometimes these are laid two in a row and sometimes three, depending on the season and condition of the canes.

The results of the experiment at Calumet Plantation possess so wide an interest that it is desirable to bring them prominently before the notice of those interested in sugar production in our tropical possessions. Mr. Edson, the chemist, states :—"I do not know that any experiments " such as this at Calumet have, up to the present time, ever been tried " with sugar-cane. It seems to me to be an entirely new and untried " ground in experimentation, though the advisability of such work being " tried has often been discussed."

The following extracts relating to the experiments at Calumet Plantation are taken from Mr. Edson's Report (*Bulletin* No. 8, pp. 26–39) :—

'SEED' SELECTION OF SUGAR-CANE.

"During the autumn of 1890, after grinding was well under way, a series of single stalk analyses were made in the laboratory for the purpose of testing whether sugar canes would transmit to their offspring the relative higher or lower sucrose content which they themselves possess. By repeated experiments a transverse section of the cane was found that represented very accurately the quality of the whole cane, this part was cut out, analysis made of its juice, and the remainder of the cane saved for seed. This section was the third one from the bottom when the canes were cut into four pieces of equal length. Below is given a table of analyses made to test the matter :—

Longitudinal Halves of Samples.			Third Quarter from Bottom of opposite Halves of Samples.		
Solids.	Sucrose.	Purity.	Solids.	Sucrose.	Purity.
14·7	11·9	80·9	15·4	12·8	83·6
15·1	12·3	81·4	15·2	12·3	80·9
16·1	13·8	85·7	16·1	13·9	85·3
16·1	13·6	83·9	16·5	13·8	83·6
17·1	15·4	90·1	17·1	15·3	89·4
18·3	16·5	90·2	18·2	16·4	90·1
16·4	13·3	81·1	16·4	13·7	83·5
16·1	13·3	82·6	16·1	13·5	83·8
16·2	13·8	85·2	16·4	14·0	85·4

"I have since thought that for different years the section which represented the quality of the cane might be different, but as it has been found out since that a selection of this kind is not necessary, I have made no further experiments. Selections were first made with the Brix spindle, by which means all canes containing a medium amount of solids in the juice were discarded, leaving only the extremes of the rich and poor canes. The juice from these latter was taken into the laboratory for further analysis, and all canes of low per-centage of solids in the juice and having a purity under eighty-five, were planted as representing the poorest canes to be found. In like manner the richest canes were selected from those containing a high per-centage of solids and having a purity over eighty-five.

" Both extremes were taken in preference to one, because it was thought that if anything was to be gained by this line of experimentation it would be shown much quicker by watching the progeny of vital opposites instead of comparing only one extreme with an average, which, to say the least, would be very difficult to obtain. In fact, selecting the extremes was the only way a comparison could be made. If only the richest canes had been selected there would have been no standard by which to judge whether anything had been accomplished. With the extremes if there is a difference in their offspring, there must, also of necessity, be a difference between each of their offspring and the mean. We have, then, if we find that the richest canes which can be selected produce a cane richer than that from the poorest canes selected, proven that this resulting cane is also richer than the average of the lot of cane from which the selections were made would have produced, had the canes of medium sucrose content not been thrown out. . . . .

" In reviewing also what continually is coming under our notice I cannot either see any reason why disbelief should exist as to some good being accomplished by this line of investigation. Rich and poor canes are continually coming to our notice from the same part of a field and where the conditions for their development seem to be as favourable to one as to the other. Anyone who has made a great number of single stalk analyses, as has been done here, is especially aware of this. It is also evidenced by the almost total impossibility of getting samples from a piece of standing cane which will accurately represent the whole plat. The extent of this variability can perhaps be better appreciated by comparing sugar cane with sorghum, a plant which has had a very unenviable reputation as regards the vagaries of its individual stalks. . . . .

" There is a belief among the Creole planters that the Ribbon cane as commonly known in this State reverts to the Purple, though no scientific observations have been made to test the truth of the belief. Dr. Stubbs, at the Experiment Station, has had, I believe, some difficulty in securing a pure stock of these two varieties, but has not attributed his trouble to one cane changing to the other. If there is any truth in the belief, it would suggest the probability that many of the existing varieties were derived in the same way instead of by *sudden* bud variation. If this were so it would add another link to the chain of suppositions which led me to believe that the plant could be educated to meet our wants. Variation in fact seems to be the only law that we can depend on with safety at the present time. Why, then, can we not take advantage of this continual change and train it to meet our wants? If we cannot bring it to excel its original qualities, cannot we, at least, keep its standard up to the quality of its present best individuals? If three-tenths of one per cent. of the weight of cane is added to it in sugar, a crop of 25,000 tons of cane would give 150,000 additional pounds of sugar, five-tenths of one per cent. would give 250,000 pounds additional, and one per cent. would add 500,000. . . . . .

" At Calumet 780 single stalks were examined, 424 of which were discarded by the Brix spindle work as being canes of medium richness, and the remaining 356 analyzed, giving about an equal number of the extremes of rich and poor canes. The canes from these analyses planted but two rows 575 feet long, while seed from the same number of stalks of sorghum would have planted many acres. We can see by this the Herculean nature of the task undertaken, and therefore the necessity for extreme care that the experiments be not lost. The average analysis of the rich canes planted here was solids 16·6, sucrose 14·7, purity 88·6; of the poor canes, solids 14·9, sucrose 11·9, purity 79·9. This gives a difference in the analyses of 1·7 solids, 2·8 sucrose, and 8·7 purity. This difference was not, perhaps, inherently as great in the canes examined as the analyses would indicate, for many of the stalks were no doubt influenced greatly by their environments, and after removing them from these, the peculiarities themselves would in considerable part disappear. These peculiarities, due to environment, would, probably, all be eliminated in time by continued planting of canes from selected plats. During November 1891, at intervals of a week, the plats were twice sampled. Samples were taken from directly opposite points of the two rows, and every stalk growing in the space sampled was cut. The analyses of each in the laboratory were, of course, made by identical methods. These analyses were as follows:—

HIGH SUCROSE PLAT.

Analysis of November 20.—Solids 15·2, Sucrose 11·6, Purity 76·3.
Analysis of November 27.—Solids 14·4, Sucrose 10·7, Purity 74·3.
Average.—Solids 14·8, Sucrose 11·2, Purity 75·7.

LOW SUCROSE PLAT.

Analysis of November 20.—Solids 15·1, Sucrose 11·1, Purity 73·5.
Analysis of November 27.—Solids 14·4, Sucrose 10·7, Purity 74·3.
Average.—Solids 14·8, Sucrose 10·9, Purity 73·6.
Difference.—Solids 0·0, Sucrose 0·3, Purity 2·1.

"There was also undoubtedly a less yield of cane from the poor sucrose seed. This was so very evident that it did not need the authority of actual weights to confirm it.

1892 RESULTS.

"In discussing the data secured the present year on this subject, I have divided it into two phases, both of which seemed distinct and important enough for separate remarks. These are the results obtained from last year's selection and so have had but small opportunity for reversions, if such are to occur, and the other the results obtained from two plats, the original parents of which were from selected seed, the one from poor canes and the other from rich ones—but in which they had been allowed to grow one year without any intermediate selection. This latter, then, has been subjected to only the one original selection, but each plat kept free from intermixture with the other.

"The canes were planted two in a row without any lap and the tops and butts of the planted canes were kept opposite so as not to have the general growth of the cane in the row affected by the varying germinating qualities of the different sections of the cane.

"The method used in selecting the rich and poor canes was somewhat different from that employed the first year. Then as a preliminary part of the work a number of tests were made to determine what section of the cane would represent the whole stalk, and having found this section, it was used for the analysis. But what has rendered this kind of work easier it was also found that from the point of comparing one cane with another any given section could be used, provided this section only was used in all the tests. So, acting on this knowledge, we have used in our selection the butt quarter of the cane, and while this does not give the sucrose content of the cane planted, it gives an accurate comparison of the quality of the canes used. The test of quality is also made solely with the Brix spindle. This is amply sufficient with sugar cane when the cane tested all comes from one plat. I have hundreds of analyses on my books at Calumet, which it would be but an incumbrance to print here, showing without exception, that under such conditions a high per cent. solids invariably means a correspondingly high sucrose, and, in a vast majority of cases, a higher purity than the lower solids. The average per cent. solids of the richer canes planted was 19·5, and of the poorer 17·2, a difference of 2·3. It was a noteworthy fact that nearly all the richer canes were also the larger ones, and the joints were longer than in the poorer canes. This would have, as the plats were the same length, given a larger number of eyes to the poor canes, and so should have given a larger number of canes, but from some cause it did not.

ANALYSES OF CANES FROM SINGLE STALK SELECTION.

Rich Cane Seed.				Poor Cane Seed.			
Date.	Solids.	Sucrose.	Purity.	Date.	Solids.	Sucrose.	Purity.
Oct. 24 -	17·0	14·0	82·3	Oct. 24 -	16·6	13·2	79·5
Nov. 1 -	17·5	15·2	86·9	Nov. 1 -	16·1	12·6	78·3
Nov. 5 -	17·1	13·9	81·3	Nov. 4 -	16·6	13·9	83·7
Nov. 7 -	16·4	13·4	81·7	Nov 7 -	16·0	13·0	81·2
Nov. 8 -	16·3	13·2	81·0	Nov. 8	15·7	12·8	81·5
Nov. 11 -	16·1	13·1	81·4	Nov. 11 -	15·9	12·6	79·3
Nov. 12 -	16·6	14·3	86·2	Nov. 12 -	16·5	13·3	80·6
Means -	16·7	13·9	83·2	Means -	16·2	13·1	80·9

"In the spring, after the canes had begun to appear in considerable numbers, they were counted in each row, and this counting was continued weekly till the number of canes either remained practically stationary or began to decrease, and, finally, another count was made in the fall just before grinding. The last mother canes in each plat appeared during the week ending May 15th. The rich canes seem to have given their progeny a little the better start, as there were 371 mother canes against 350 for the poor canes, and this slight advantage in the number of canes continued into August, but at time of harvest the amount of canes in each plat was almost identical, the plat from rich seed having 875 canes against 870 in the other. Fourteen of the canes in the rich seed plat died before reaching maturity, and seven in the poor seed plat. In point of number of canes grown or those lost before reaching maturity no preference can be given to either plat.

"I will now call attention to the relative amount of cane from the two plats. It will be remembered that last year, while no actual weights were made, it was remarked that the cane from the rich seed gave a larger, healthier-looking stalk, this being so very pronounced that there was no mistaking it. This present year all the samples brought in were weighed, and as the same number of canes were taken from each plat at every sampling, and these samples extended through the whole length of the rows, a very good idea can be formed of the relative quantity of cane. This is best expressed by giving the average weight per stalk. For the cane from poor seed this was 2·58 pounds, and for the cane from the rich seed 2·42 pounds, a showing against the rich cane seed. While it may be that each year we will have a return in quantity similar to this, I am at present inclined to think that the rich cane will in the end prove the larger one.

"It is true that with sorghum and beets the medium-sized plant is the most satisfactory one to grow for sugar; yet I believe that it could not in the same way be said of these that the smaller or medium sized *seed* are as satisfactory for planting as the large ones, containing, as they would, a much greater amount of starch to be transformed into food for the young plantlets. So, I believe, it will be with sugar cane, and that the larger healthier stalks will, in a series of years, produce the thriftiest canes, for I have continually noticed that in the selections the rich canes are the larger and better stalks. In three of the samples taken the weight of cane from the rich seed exceeded that from the poor, the other four samples giving opposite results. Also it was noticeable that at one end of the rows one plat contained the larger looking cane, and at the other end the other plat did, and the samples taken corresponded to this appearance. Certainly, from the limited trials made here, it would not be the part of wisdom to assert positively whether the rich cane seed will give a larger or a smaller cane, as the two years' results have been contradictory in this particular. Such contradictions, however, are to be expected in field agricultural experiments, and it will take the average results of a number of years to furnish ultimate proof.

"We now come to the most important part of the work in judging of its utility, viz., the analytical results. Seven sets of analyses were made, and then it had become so late in the fall that it was deemed expedient to make the selections for planting, and as this took all the canes it stopped further analyses. The last analyses were made on November 12th. These samples were, with one exception, taken from directly opposite parts of the two rows and contained the same number of canes. The one sample taken differently was during the time the selections for further planting were being made, and consisted of every thirtieth cane as the plat was being ground. This method of cutting out sections of the row in sampling standing cane for comparison of different plats I have found to be the most satisfactory tried. It is much better than going through the whole plat and trying to select average canes.

"There is in these analyses but one case, that of November 4th, where the cane from the poor seed could be said to be better for sugar-making than that from the rich seed. The average of the analyses shows the cane from the rich seed to be eight-tenths of one per cent. higher in sucrose and 2·3 points higher in purity. Now let us see what such a difference in analyses means in sugar-making. Allowing 10 per cent. marc, about the average in Louisiana, there would be a difference between the plats of 14·4 pounds of sugar in each ton of cane. This difference divided by two, because one plat was as much below the average cane seed as the other was above, will give 7·2 pounds of sugar per ton as an increase in planting rich cane for seed, instead of the average cane, had it been planted.

"For a factory grinding 400 tons of cane per day this would add 2,880 pounds of sugar to the cane of a day's working, and for a crop of 25,000 tons would give 180,000 additional pounds of sugar. One hundred and eighty thousand pounds of sugar at five cents per pound is worth $9,000, and $9,000 would pay for 2,000 tons of cane at the price of $4·50 per ton, and 2,000 tons are nearly one-twelfth of the entire crop. This, it must be borne in mind, is the result of one year's selection. There is still another added value in the cane from the rich seed of which it is more difficult to give the exact value; this is the higher purity of 2·3. We know that a high purity is more desirable than a low one, but no one yet has been able to tell what a rise of a point in purity will add to the sugar output. To form some estimate we can take a given per cent. solids and figure what per cent. sucrose the two purities would give. Taking thus the average per cent. sucrose of the juice from the rich cane seed we will have the sucrose as given in the table of analyses for the cane from rich seed and 13·5 per cent. would have been secured on the cane from the poor seed plat had the per cent. solids been the same as in the other. There is, then, a difference of four-tenths of one per cent. of sucrose due to purity alone. Halving this for the same reason as given before we would get two-tenths of one per cent. extra sucrose over the average, or 3·6 pounds per ton. This then should be added to the actual gain in sucrose made, aside from the question of purity, and would give instead of the 7·2 pounds, 10·8 pounds additional sugar per ton of cane. Carrying this out in figures the same way as before we would have for a day's work of 400 tons an increase of 4,320 pounds of sugar, and on a crop of 25,000 tons 270,000 pounds. This, at five cents per pound, amounts to $13,500 and would at the rate given before buy 3,000 tons of cane, which is but little less than one-eighth of the entire crop. Expressing this gain in another way it would give an abundant amount of money to pay the sugar-house labour for manufacturing the crop. This result was obtained from planting canes the average per cent. solids of whose juices differed by 2·3 points, thus making the richer canes better than the average would have been by 1·15 per cent. It is undoubtedly a remarkable showing.

ORIGINAL SEED SELECTION WORK.

" We turn now to the other phase of our subject in which one year had intervened without selection since the original selection was made. As explained, this was because the cane was too small to analyse a part and still have some left for planting. It will be seen then that the canes analysed this year while of pure bred stock from the original rich and poor canes has not the added value that another year's selection might have given. The results, however, should be expected to be very interesting in having a bearing on the question of the stability of an improvement once made. This will of course be one of the most important phases of the subject, for, should any improvement made revert to the original state after one year, the work would be in vain, as enough cane cannot be selected in one year to be of any great value.

" The first year's work with these plats gave a difference of three-tenths of one per cent. of sucrose between them and of 2·1 points in purity. This of itself was a decided improvement, but as the cane was so small I placed no great reliance in the results, thinking that an accidental cause might have occasioned it. But during the present year the cane from the seed these plats furnished grew excellently and was well cared for, so we are thus given an excellent means of judging what one year's selection will do under continued propagation."

CANE FROM 'SINGLE STALK SELECTIONS.'

Grown two years without additional selection.

Rich Cane Seed.				Poor Cane Seed.			
Date.	Solids.	Sucrose.	Purity.	Date.	Solids.	Sucrose.	Purity.
Nov. 3 -	18·0	16·0	88·9	Nov. 3 -	17·6	15·5	88·1
Nov. 8 -	17·7	15·4	87·0	Nov. 8 -	16·8	13·5	80·3
Nov. 14 -	17·1	15·3	89·5	Nov. 14 -	17·5	14·5	82·8
Nov. 19 -	17·5	16·3	93·2	Nov. 19 -	17·5	16·2	92·6
Nov. 25 -	17·6	16·0	90·9	Nov. 25 -	17·9	15·8	88·3
Dec. 6 -	18·8	17·0	90·4	Dec. 6 -	17·8	14·8	83·1
Means -	17·8	16·0	89·9	Means -	17·5	15·1	86·3

" The average sucrose of six samples from the plat planted with rich cane seed was 16·0 and the purity 89·9. The cane from the poor seed gave a sucrose of 15·1 and a purity of 86·3. The samples were taken in the same manner as in the other plats and, as will be noticed, give a more favourable showing than they did for seed selection. I will not extend the figures as I did before, for their magnitude must already be so apparent that further discussion would be useless.

" A most important point these two plats show is that the higher sucrose from the rich cane seed is not an early forced maturity. The analyses extend up to December 6th, and there is as marked a difference in the latter ones as in the earlier. I cannot but believe then we have proven that under the same conditions for each kind of seed, no difference what these conditions are, a rich cane will produce a better progeny than a poor one.

" Having established the fact that the sugar-cane can be improved by systematic seed selection it is necessary to inquire how this can be made of practical value to a large cane grower. The results obtained have been with small experiment plats. How can such work be done for hundreds of acres ? This must be the true test of the utility of the results, for could not the large field profit by them they might as well have never been made.

" There are two possible ways, it seems to me at present, that the knowledge acquired by these experiments can be put to practical use. The first of these is by systematically sampling the cane growing on different sections of the plantation, and planting the richest for the ensuing crop. In this case, however, the conditions giving the richness are not perfectly known ; the soil, fertilizer applied, better drainage or cultivation may, one or all, have had an effect in giving the result, instead of an inherent quality in the cane itself, and that which is in reality poorer might be selected in one year's work as the better. In a number of years, though, it is more than probable that a selection of this kind would be of material benefit. The return would, in any case, be slower than the method I will now call attention to.

" A chemist can take ordinary unskilled white labourers and teach them to make the necessary Brix readings in a very short time, and by single stalk work I estimate, from the work done here, that in a month at least three acres could be planted with a high quality of seed, using only a single hand-mill to extract the juice. This work done during grinding would entail no loss, as all juice extracted and canes not selected could be used in the factory. These three acres should produce the next year at the rate of twenty tons per acre, or a total of sixty tons. At the end of one year, then, sixty tons of a high grade seed would be on hand. This, planting at the rate of four tons to the acre, would seed 15 acres and, with the three acres of stubble, would, at the end of two years, give 18 acres of pure-bred seed. The 15 acres of plant cane would give 300 tons, at the rate of 20 tons per acre, and the three acres of stubble, at 16 tons per acre, would give 48 tons, a total of 348 tons, which is enough to have at the end of the third year, with the 15 acres of stubble, 92 acres of pure-bred seed. This does not take into account the additional selections that could be made each year and which by three years would at the same rate as above give twenty-one additional acres. One hundred and thirteen acres would, in round numbers, plant 550 acres, and this is nearly as much as our largest plantations plant in one year. By the end of another year, or the fifth crop harvested since the selection was begun, there would be nothing but improved cane on the place. This would be accomplished, too, by using only the additional labour of perhaps four men during the grinding season.

" Of course continued selections, that is, selections from selections, could be going on in small plats all the time and as these became of sufficient value could be transferred to the field in the same manner as the other.

" Feeling thus so thoroughly assured that selection of 'high sucrose' canes will give a plant which is also of a superior quality, it might be well to speculate as to how far this improvement can be carried. Is it to be stopped at the end of three or four years, or is it to be continued indefinitely? If for the shorter period how much of an improvement can we expect?

" We know that propagation from cuttings will produce plants much truer to their mother species than those grown from seed. This is exceptionally true of those plants that can be grown in either way. As, for example, all fruit trees are budded, potatoes are grown from the eyes of the potato, not from the seed, and in the last few years when tropical cane seeds have been secured many distinctly different plants were, according to Professors Bovell and Harrison, grown from one parent seed head. Beet investigators, also, realising this fact, have been making experiments in growing beets from what are practically cuttings, instead of from seed as heretofore, though their work is being done to preserve true varieties rather than to have any immediate effect upon the sucrose content. Then, having accepted the fact that cuttings breed truer to the parent than seeds, is not the conviction forced upon us that an improvement inherent in the plant can be developed more quickly in cane than in seed-producing sugar plants. I do not mean by this that large quantities of a pure stock could be secured more quickly, for I have already explained why this cannot be done, but that with an equal number of stalks a plant true to its parent stock will reach its maximum sucrose content sooner, and breeding only from the best, we are more apt to get the best. We will not have to contend with the difficulty of variation from our accepted best value. It is, also, doubtless true from the same reason that we are more limited in our ultimate improvement since we cannot expect accidental variations that will be of more value than their original parent. We cannot, either, secure any of the benefits of crossing that are obtained from seed-bearers. That there are occasional variations, however, anyone familiar with the investigations of naturalists of the present day cannot very well doubt; indeed, some have actually been observed in ordinary culture, and are now being grown at the Sugar Station in this State, but it cannot be hoped even by an extreme visionist in natural selection that there would be much betterment in cane by watching for such variations. My own work, no further than it has gone, has led me much against my will to fear that the chance for continued improvement from single stalk selection is not as great as could be desired. I do not find nearly the variation in the plats which have already been subjected to one selection that I did in my original selection from the field. Where the first year the difference in per cent. solids of the two plats planted was 2·2, the selections gave but slight individual variations in either plat, and there were in each case practically the same number of canes examined. All the canes from the high sucrose plats were correspondingly high and those from the poor plat correspondingly poor. There was not in the rich plat a single stalk that I could think was distinctively richer than its associates from any quality in itself; in fact, there were none at all that were markedly superior canes to those adjoining them. I do not think the same reasoning could be held as good in regard to the cane from poor sucrose seed, as some single cane might be unusually low in sugar from an accidental cause, such as becoming wounded during cultivation, &c. . . . .

"It is my belief, then, that with a given amount of plants the improvement in sugar cane by seed selection will be more stable than in sorghum or beets, and will, on the whole, approach its maximum more rapidly, but that the limitations to its ultimate improvement are greater than in either of these. Nature, however, may aid it in the fact that the production of sugar is a function incident to the plant, while with beets and sorghum this is an educated quality. Time only can tell which of these three will ultimately excel in the world's sugar production, but whatever the outcome will be it is certain cane can take a great stride in the race, now that it has been found that seed selection will aid it."

CCCLXVI.—GUZERAT RAPE.

(*Brassica campestris* var. *glauca.*)

The seeds of rape yield on expression the oil familiarly known under the name of Colza. The residue or "cake," which contains all the nitrogenous constituents of the seed, is largely employed in this country as a valuable cattle-food.

Botanically the plant grown in Europe for the purpose is principally *Brassica campestris* var. *Napus*. In India the similar plant is *B. campestris* var. *glauca*.

The rapes are, botanically, near allies of the mustards. The seeds of these, in addition to an innocuous oil, yield, by a kind of fermentation, Mustard oil. Hence their use as a condiment. Unfortunately, however, Mustard oil produces in the stomachs of cattle an inflammation which is often fatal. It is essential, therefore, that "Rape-cake" which is used for feeding should be free from any seed containing Mustard oil.

Unfortunately, Indian rape has some of the characters of mustard. It appears to be largely imported into Europe for the purpose of oil-expression; but the residue, though saleable as a manure, cannot be safely used as a cattle-food.

The matter has often been investigated at Kew, and the accompanying documents are now published for general information.

Watt's *Dictionary of the Economic Products of India* (vol. i., pp. 522–528) may be consulted advantageously on the subject.

Prof. FERDINAND COHN to ROYAL GARDENS, KEW.

Pflanzenphysiologisches Institut der Kgl.
Universität, Breslau,
January 30, 1894.

DEAR SIR,

CAN you give me some information, to *which species* belong the seeds which come into commerce from East India, for the purpose of extracting oil in our European manufactories, under the name of Indian Colza (*Indischer Raps*)? The seeds are different from our common *Brassica Napus;* they seem to be produced by several species or varieties of *Cruciferæ*, their testa being gray, red, or yellow. I beg to send specimens of three samples (Cawnpore, Guzerat, and Ferozepore). The manufactories of Breslau buy annually many millions of kilos of Indian "Rape" for the extraction of oil; our farmers assert the cakes to be injurious to cattle, and to contain *mustard seeds;* hence law-suits. I suppose I may get from the collections of your Museum *authentic* information, and perhaps also little specimens of the well-defined species of seeds.

Believe, me, &c.
(Signed) PROF. FERDINAND COHN.

EXTRACT from *Kew Report* for 1877, p. 34.

Guzerat Rape.—Inquiry has been made both in England and in Germany with regard to a rape seed imported into the English market from Bombay under this name, and which Dr. Wittmack, of the Berlin Agricultural Museum, has identified as the seed of *Brassica* (*Sinapis*) *glauca*, Roxb. This species is undoubtedly merely a local variety of the common rape, and must be referred, therefore, as is done in the *Flora of British India*, vol. i., p. 156, to *Brassica campestris*, Linn. At first sight the seed as imported resembles a mixture of ordinary rape with white mustard, and it has even been taken to be this. The careful examination of Dr. Wittmack, however, shows conclusively that the structural characters of the seeds are those of rape and not of white mustard, and there is reason to suppose that the white as well as the dark seeds are all the produce of the same plant (*Sitz. d. Gesellsch. Naturf. Fr.*, January 16, 1877). Guzerat rape seed has been crushed at Danzig, and is found to yield 3·5 per cent. more oil than rape; the cake also yields 10 per cent. fatty matter and 34 per cent. albuminoids, both being in excess of the amounts yielded by ordinary rape. Dr. Wittmack, however, remarks, that as the seed has a distinct flavour of mustard, the cake may not be very suitable for cattle feeding.

CCCLXVII.—AGRICULTURE IN BRITISH HONDURAS.

An account of the resources of British Honduras was printed in the *Kew Bulletin* for November last (1893, pp. 326–329). In the Annual Report for the year 1892 (*Colonial Office Reports*, Annual, No. 94, 1893), the Administrator gives a further interesting note on the agricultural condition of the Colony. The singularly undeveloped condition of this British possession in Central America, first settled as long ago as 1662, is shown by the fact that out of five million acres, the total estimated area, there are only forty thousand acres returned as under cultivation at the close of 1892. There is apparently considerable depression in regard to logwood and mahogany, which have hitherto been the chief articles of export. Up to the present time the Colony has mainly depended for its existence upon the cutting of these valuable native timbers. The one cheering fact in the agricultural condition of British Honduras at the present time, is the gradual and steady development which has taken place during the last few years in the fruit trade. In order of importance the value of the vegetable products of the Colony exported during 1892 is as follows:—Logwood, $616,838; mahogany, $389,855; bananas, $212,882; plantains, $12,191; rubber, $7,450; and West India cedar (*Cedrela*), $2,610. The fruit exports, including cocoanuts, are now almost two-thirds of those of mahogany. There is every indication that with due encouragement these are destined, as in Jamaica, to occupy a very prominent position in the future. Moreover, the cultivation of fruit, especially bananas, leads to the permanent establishment of the land in coffee, cacao, spices, and other tropical staples.

Agricultural Statistics.

The estimated acreage of the Colony is 4,839,408 acres, of which 45,000 are returned as being under cultivation, and 4,155,000 as being uncultivated. The estimated acreage of mahogany and logwood works is 3,065,000 acres. All town and suburban lands belonging to the Crown have to be sold by public auction at an upset price fixed by the Governor in Council, which generally ranges from $1 an acre upwards, and cannot be sold privately; whilst leases of Crown land are also granted by the Governor in Council at rates varying from 25 cents an acre per annum, subject to such conditions as the circumstances of each application may seem to require. In order to encourage immigration and develop the resources of the Colony, the Governor in Council is empowered by law to issue free grants of rural lands to persons who may desire to settle in the Colony, in lots not exceeding 20 acres for each adult above 18 years of age, and 10 acres for each person under that age, subject to such conditions as to improvements or residence as may be imposed.

It is estimated that about 3,075,984 acres of land in the Colony have been granted, and that about 1,763,424 acres remain ungranted.

The principal products of the Colony, in addition to mahogany and logwood, are sugar, bananas, rum, Indian corn, coffee, rice, and cocoanuts.

The following table gives the [approximate] quantity produced from 1889 to 1892. The returns of bananas and cocoanuts are given for the first time in 1892:—

—	Sugar.*	Bananas.	Rum.	Indian Corn.	Coffee.	Rice.	Cocoanuts.
	Lbs.	Bunches.	Proof gallons.	Bushels.	Lbs.	Bushels.	No.
1889 -	2,390,900	not given	67,966	100,451	931	1,718	not given
1890 -	2,094,536	not given	78,191	137,806	632	1,316	not given
1891 -	1,655,664	not given	52,757	105,840	87	963	not given
1892 -	1,953,762	260,000	68,146	87,640	20,000	625½	2,860,000

* In 1889 and 1890 the heading is "sugar and concrete."

CCCLXVIII.—DECADES KEWENSES.

PLANTARUM NOVARUM IN HERBARIO HORTI REGII CONSERVATARUM.

DECAS VIII.

71. **Heliophila tenuis,** *N. E. Brown* [Cruciferæ]; caulibus gracilibus basi decumbentibus subglabris (pilis sparsissimis instructis), foliis alternis adscendentibus integris lanceolatis acutis basi angustatis sessilibus glabris vel sparsissime hirtis, floribus parvis (alabastris tantum visis), sepalis glabris apice breviter membranaceis dorso gibbosis, siliquis erectis glabris linearibus marginibus parallelis, valvis trilineatis, stylo subulato, seminibus compressis late marginatis.

Habitat.—South Africa, Zwarteberg, *Pappe.*

Caules 6–15 poll. longi. *Folia* ½–¾ poll. longa, 1-1½ lin. lata. *Pedicelli* fructiferi 4–6 lin. longi. *Siliqua* 1¼–1½ poll. longa, 1 lin. lata. *Stylus* 1½–2 lin. longus.

A very distinct species, having the appearance of a perennial, but the rootstock of the plant is not present in the Kew specimen.

72. **Abutilon Ranadei,** *Woodrow et Stapf* [Malvaceæ]; frutex, ramulis novellis furfuraceis mox glabratis vetustioribus pallide fuscobrunneis, foliis rotundato-cordatis longiuscule et anguste acuminatis sinu profundo angusto vel in minoribus magis aperto crenatis vel obtuse dentatis junioribus utrinque velutino-tomentosis adultis supra plus minus glabrescentibus 7-9-nerviis nervis venisque subtus prominentibus, petiolis robustis 2/3 laminae aequantibus, stipulis subulatis tomentosis valde caducis, floribus solitariis in axillis foliorum ramorum abbreviatorum, pedicellis furfuraceo-tomentellis sub apice saepe recurvis vel refractis, calyce velutino-tomentello campanulato lobis tubo aequilongis ovato-lanceolatis acutis, corolla campanulata petalis calycem plus quam duplo superantibus obovato-cuneatis aurantiacis basin versus purpureis venis distinctis prominulis, staminum tubo breviter fisso basi exannulato, carpellis 5 breviter rostratis stramineis villosulis.

Habitat.—Ratnagiri, Amba Ghat, *N. B. Ranade.*

Frutex 4 ped. altus. *Folia* ad 7 poll. longa, ad 5½ poll. lata; *petiolus* ad 4½ poll. longus. *Pedicelli* 1 poll. longi. *Calyx* 9–11 lin. longus. *Petala* 1½ poll. longa, ad ½ poll. lata. *Carpella* 10 lin. longa.

This is a very marked species. Its affinity with *A. polyandrum*, Don. is quite clear; but it differs considerably in the bell-shaped corolla and in the length of the staminal tube.

73. **Rhynchosia comosa,** *Baker* [Leguminosæ; *Tribe* Phaseoleæ]; sarmentosa, caulibus lignosis dense pubescentibus, foliis trifoliolatis facie tenuiter dorso dense pubescentibus, stipulis parvis lanceolatis pilosis, foliolo terminali suborbiculari, racemis densis oblongis longe pedunculatis, bracteis magnis lanceolatis herbaceis persistentibus, pedicellis brevibus, calyce densissime hirsuto tubo brevi dentibus longis setaceis, corollâ calyce sesqui-longiori, petalis subæquilongis glabris, ovario cylindrico piloso.

Habitat.—Nyassaland, *Buchanan*, 234 of 1881 collection, 390 and 687 of 1891 collection.

Foliola 2–4 poll. lata. *Racemus* 3–4 poll. longus. *Calyx* 6 lin. longus.

A handsome plant, remarkable for its dense heads of flowers, large persistent bracts, and very shaggy calyx, with setaceous teeth.

74. **Petalactella,** *N. E. Brown* [Compositarum-Gnaphaliearum genus novum]. *Capitula* heterogama, disciformia; floribus in ambitu ♀ 2–4 fertilibus, in disco ♂ sterilibus. *Involucrum* campanulatum, bracteis sub 3-seriatis, exterioribus flores fœmineos subtendentibus, interioribus breviter radiantibus. *Receptaculum* parvum in disco nudum. *Corollæ* fl. ♀ compresso-tubulosæ, minute dentatæ, fl. ♂ regulares, tubulosæ, limbo anguste campanulato 5-fido. *Antheræ* basi brevissime caudato sagittatæ. *Stylus* fl. ♂ indivisus, fl. ♀ bifidus, ramis linearibus obtusis vel subtruncatis. *Achenia* fl. ♀ subtrigona; fl. ♂ subnulla. *Pappi* setæ fl. ♂ paucæ, 1-seriatæ, liberæ, apice incrassato-penicillatæ; fl. ♀ nullæ vel interdum 1–2. *Fruticulus* ericoideus. Folia alterna, parva. Capitula parva ad apices ramorum aggregata.

P. Woodii, *N. E. Brown;* nana, lignosa, prostrata, ramis brevibus confertis, foliis confertis imbricatis vel subpatentibus linearibus subtrigonis rigidis supra albo-canaliculatis obtusis vel minute apiculatis glabris novellis argenteis, capitulis ad apices ramorum 1–5 aggregatis, inter folia sessilibus, involucri squamis exterioribus circa 4–5 late lanceolatis acutis marginibus late membranaceis extus lanatis fl. ♀ circa 3–4 subtendentibus, squamis interioribus biseriatis oblongis basi angustatis apice obtusis vel subacutis subdenticulatis breviter radiantibus albidis glabris vel dorso parce lanatis marginibus ad medium late membranaceis, disci floribus 10–12 sterilibus, pappi setis 4–6 apice pulchre plumosis, acheniis fl. radii obovatis subtrigonis vel plano-convexis papillato-scabris, 1–2-setosis vel calvis.

Habitat.—Rocky hill near Harrismith, Orange Free State, at about 5,000 ft. alt. *Wood*, 4813.

Planta 2–3 poll. alta. *Folia* $1\frac{1}{2}$–$2\frac{1}{2}$ lin. longa, $\frac{1}{4}$ lin. lata. *Inflorescentia* $\frac{1}{4}$ poll. diam. *Capitulum* $\frac{1}{8}$ poll. diam.

In general appearance this remarkable little composite bears some resemblance to *Helichrysum ericæfolium*, Less., but seems to be a dwarfer and more woody plant, and in the structure of its flowerheads is totally different, being quite unique in the group *Gnaphalieæ*, and perhaps in the whole order, in having the female filiform florets in the axils of the outermost involucre scales, and separated from the male or disk florets by the two inner rows of involucral scales, which merely surround the disk florets. The nearest allied genus is *Petalacte*, in which the female florets are subtended by the inner involucral bracts and placed in the same series as the outer male florets, and the male florets in the centre of the disk are surrounded by 3 or 4 scales like those of the involucre, but there are no florets in the axils of the outer involucral scales. Another difference is the form of the scales of the involucre; in *Petalacte* they are all alike, with a densely woolly, linear claw, and a broadly spathulate or orbicular, radiating tip; whilst in *Petalactella* the outer scales are broadly lanceolate, laxly woolly, and with erect (not radiating), acute tips, and the inner ones oblong, narrowed at the base, nearly glabrous, with shortly radiating obtuse or subacute tips.

75. **Ceropegia Rendallii,** *N. E. Brown* [Asclepiadaceæ]; volubilis gracilis glabra, foliis ovatis acutis vel lineari-oblongis subobtusis vel abrupte acutis mucronulatis petiolatis, pedunculis 1–3-floris, bracteis subulatis, floribus breviter pedicellatis, sepalis subulatis, corollæ tubo

leviter curvato, basi globoso inflato superne ampliato, lobis unguiculatis cordatis in umbraculum ciliatum connatis, corona exteriore cupulata 5-lobata, lobis compressis dolabriformibus subrecurvis cum dentibus minutis quinque alternatis, interiore subnulla vel dentibus quinque minutis antheris adnatis.

Habitat.—Transvaal, *Rendall.*

Folia ¾–1½ poll. longa, ⅛–⅝ poll. lata. *Pedunculi* ¼–¾ poll. longi. *Bracteæ* ½–1½ lin. longæ. *Sepala* 1½ lin. longa *Corolla* ¾ poll. longa, umbraculo ⅓ poll. diam.

A small twining species recently sent to Kew by Dr. P. Rendall, of Barberton, after whom it is named. The corolla is very similar to that of *C. Sandersoni* on a small scale. The base of the corolla-tube appears to be purple, the upper part white, and the umbrella formed by the lobes green.

76. **Ipomœa Woodii,** *N. E. Brown* [Convolvulaceæ]; radice magna tuberosa, caule longissimo nudo apice tomentoso folioso, foliis longe petiolatis rotundato-cordatis obtusis apiculatis supra glabris subtus pubescentibus, pedunculis quam petiolis duplo brevioribus 2–3-floris tomentosis, pedicellis quam pedunculis longioribus subglabris vel sparsissime pilosis, sepalis latissime oblongis obtusissimis glabris, corolla magna roseo-purpurea infundibuliformi.

Habitat.—Zululand, *Wood*, 4146, 4864.

Caulis 10–40 pedalis. *Foliorum* petioli 1¼–6 poll. longi, laminæ 2½–5½ poll. longæ, 2¼–5 poll. latæ. *Pedunculi* 6–8 lin. longi. *Pedicelli* ¾–1 poll. longi. *Sepala* 4–5 lin. longa, 3–4 lin. lata. *Corolla* 2½–3 poll. longa et lata.

This handsome new species of *Ipomœa* is dedicated to Mr. J. M. Wood, the energetic Curator of the Botanic Garden, Durban, Natal, to whom Kew is indebted for many interesting new plants, and among them this one, which it is hoped will shortly be in cultivation at Kew. Mr. Wood gives the following account of it:—"The root is tuberous, "and, as I found it in Zululand, it was some 30–40 feet inside the "forest, the naked stem lying on the ground and producing a quantity of "fine foliage at the outer edge of the bush." And in another letter he states that:—"The foliage is handsome, the younger leaves being dull "purplish beneath, and the flowers are a good pink." The position of *I. Woodii* in the genus is evidently nearest to *I. Baclii*, Choisy (I. Lindleyi, *Choisy*), and *I. beraviensis*, Vatke. It is very similar to the latter, but has rounder leaves and shorter pedicels.

77. **Nicotiana flexuosa,** *Jeffrey* [Solanaceæ]; pubescens, viscosa, caule e basi ramoso erecto, ramulis flexuosis apice tantum floriferis, foliis radicalibus sessilibus tenuiter papyraceis obovato-spathulatis vel oblongo-spathulatis rotundatis obtusis vel interdum subacutis deorsum attenuatis valde undulatis, costa crassa, venis primariis lateralibus foliorum bene evolutorum utrinque 7–11 sat conspicuis, caulinis minoribus angustioribus semiamplexicaulibus supremis linearibus nec amplexicaulibus, inflorescentia laxe paniculata (plantarum depauperatarum vix ramosa) bracteis parvis linearibus cito deciduis, pedicellis brevibus, floribus parvis nutantibus, calyce anguste campanulato, dentibus leviter inæqualibus erectis lineari-lanceolatis acutis tubum æquantibus, corolla extus puberula infundibuliformi, tubo leviter inflato, limbo patenti æqualiter 5-lobo, lobis rotundatis apiculatis, genitalibus inclusis vel stylo brevissime exserto, filamentis ima basi dilatatis barbatis, capsula ignota.

Habitat.—Montevideo, *Gibert*, 50 and 131, *Tweedie*, 1398.

Caulis 1–2 ped. altus. *Folia* 4–7 pol. longa, 1–2½ poll. lata. *Calyx* 4–6 lin. longus, *dentibus* 2–3 lin. longis. *Corolla* 6–9 lin. longa, lobis 4 lin. longis.

This is cited as "*N. noctiflora*, Hook.?" in Gibert's *Enum. Pl. Montevid.* p. 35; but, as pointed out by Mr. Bentham (MS. in Herb. Kew), it is much nearer to *N. bonariensis*, Lehm, differing primarily in the more spreading inflorescence and narrower leaves.

79. **Nicotiana breviloba**, *Jeffrey* [Solanaceæ]; tota glanduloso-pubescens, foliis petiolatis crassiusculis papyraceis late ovatis cordatis valde undulatis apice rotundatis costa et venis primariis utrinque circiter 4 crassissimis, inflorescentia stricte racemoso-paniculata, paniculis longe pedunculatis, bracteis minimis subulatis, floribus angustis brevissime pedicellatis, calyce pubescenti campanulata dentibus leviter inæqualibus brevibus triangularibus vix acutis, corolla tubulosa fere cylindrica sursum leviter inflata lobis parvis rotundatis reflexis, staminibus inclusis infra medium corollæ tubi insertis filamentis basi barbatis et leviter dilatatis, fructu globoso calyce incluso.

Habitat.—Coquimbo, Chili, *Cuming*, 860.

Folia 5–7 poll. longa, 5 poll. lata, petiolo 1 poll. longo. *Calyx* 6 lin. longus. *Corolla* 1¾ poll. longa. *Filamenta* 1¼ poll. longa.

79. **Clerodendron aucubifolium**, *Baker* [Verbenaceæ]; fruticosum, glabrum, foliis breviter petiolatis oblongis acutis integris subcoriaceis basi cuneatis, floribus magnis in cymis laxis terminalibus dispositis, pedicellis elongatis, calycis tubo oblongo, dentibus parvis deltoideis cuspidatis, corollæ tubo gracili cylindrico calyce 2–3 plo longiori, lobis obovatis subæqualibus cuspidatis, genitalibus lobos bis v. ter excedentibus.

Habitat.—North Madagascar, *Baron*, 6408, 6151.

Folia 6–8 poll. longa, medio 3–3½ poll. lata. *Calyx* 10–12 lin. longus. *Corollæ* tubus bipollicaris vel interum longior; lobi 5–6 lin. longi.

Near *C. rubellum*, *magnoliæfolium* and *arenarium*, Baker, from which it differs by its long slender corolla tube. The genus is represented in Madagascar by many large-flowered large-leaved species, which are well worthy of being brought into cultivation.

80. **Balanophora hookeriana**, *Hemsl.* [Balanophoreæ]; planta minima ♀ gracilis, caule paucisquamoso, squamis latis amplexicaulibus rotundatis superioribus quam internodiis brevioribus, spica brevis breviter pedunculata, floribus bene evolutis non visis sessilibus cum bracteis clavatis intermixtis.

Habitat.—Myrung, Khasia mountains, *J. D. Hooker* and *T. Thomson*, 1850.

Planta circiter 1¼ poll. alta. *Squamæ* maximæ sesquilineam longæ. *Spica* ♀ vix sesquilineam longa.

The history of this miniature *Balanophora* is very curious. Last year, when transferring some spirit-specimens of *Cordyceps* to the Herbarium, Mr. Massee found the plant in question, which he soon ascertained was not a fungus; yet, on comparing it with Berkeley's original drawing of *Cordyceps racemosa*, published at the same time as *C. falcata* in Hooker's *Kew Journal of Botany*, vi. p. 212, t. 8, fig. 3, it appeared to be the organism from which a part at least of the drawing was made. The original drawing shows the scales on the stem, but the published figure does not, and strange to say Berkeley concludes his description of *Cordyceps racemosa* with the remark that it might easily be passed over as an imperfect *Balanophora*. It would appear that he fell into an inexplicable blunder, for there is nothing else to represent the *Cordyceps*.

CCCLXIX.—ARTIFICIAL PRODUCTION OF CITRIC ACID.

The mode of production of vegetable acids in the plant is a problem beset with much difficulty. Liebig thought that they, or at least the more highly oxidised, were formed from carbonic acid and water in plant cells containing chlorophyll and under the direct influence of sunlight. He regarded them as steps towards the building up of more complex substances. According to this view. they would belong to what is called technically the ascending series of the products of plant metabolism. The principal argument upon which Liebig rested this conclusion is the undoubted fact that most fruits which when unripe are extremely acid, on maturing usually become sweet. Professor Vines, however, points out (*Physiology of Plants*, p. 230) that "the sugar " may be produced from starch, and the diminution of the acidity may " be attributed to the neutralisation of the acids by bases." It appears, however, that the proportion of mineral matters diminishes in fruits as they ripen ; the supposed neutralisation of the acids, therefore, cannot hold good. It further appears that the acids do actually diminish and the sugar increases in ripening fruits.

Nevertheless the general drift of our knowledge of the subject has pointed to the conclusion that vegetable acids are, as a matter of fact, the result of the breaking down of a carbohydrate, probably a sugar. They belong, therefore, to the descending series of plant metabolism.

This has recently received a most interesting confirmation from the discovery of a method by which citric acid can be directly produced from a sugar (glucose) by growing on it a fungus, one of the " moulds."

The discovery is of more than theoretical interest, great as that is. Citric acid is largely used in the arts, and its production is the support of an important cultural industry in the south of Europe and in the West Indies, where the lemon and lime are largely grown on a considerable scale for the purpose. The destruction of this industry may bring about troublesome political consequences, and it is curious to reflect that these may owe their origin to a deduction from purely theoretical considerations.

The first notice of the matter which reached Kew was in the *United States Consular Reports* [December, 1893, pp. 469–470]. The account is reproduced here:—

New Process for Making Citric Acid.

Dr. Carl Wehmer, a Hanoverian botanist, is said to have recently discovered that sugar solutions exposed to the action of certain microscopic fungi, the spores of which float in the atmosphere, become transformed into citric acid precisely identical with that extracted from the lemon.

The first experiments made to prepare citric acid artificially in this way are said to have given excellent results, 11 kilograms* of sugar producing 6 kilograms of crystallised citric acid.

The new process has already been patented in several countries, including Italy ; and at the factory at Thann the distinguished chemist, Scheuren-Kestner, is now carrying on experiments with a view to applying the process on a large scale. Everything tends to show that this new process will assume great development, and will make it possible to supply the trade with citric acid at a much lower cost than that actually ruling, and will in all probability supersede in a few years the present method of producing lemon juice and citrate of lime.

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* 1 kilogram = 2·205 pounds.

The article from which I quote closes by saying:—"We make haste "to notify our readers, so as to put lemon-growers on their guard, and "to prevent new investments being made in this branch of agriculture, "which must receive a great blow from this new method of preparing "citric acid, and thereby sustain heavy losses."

To show what is meant by "heavy losses," I would refer to my report dated January 8, 1889.* In the year 1887, from Messina alone, 4,438 pipes of 130 gallons of lemon juice (used to fix colours in calico-printing), and valued at $635,834, were exported. A large quantity of crystallised citric acid was also exported.

Unmerchantable lemons are turned to great account, in Sicily more particularly, by extracting the essence from the peel and by converting the juice into concentrated lemon juice. Should this resource now be taken from the Sicilian lemon-grower, he will indeed sustain a heavy loss.

While Florida and California lemon-growers will not be affected by this new discovery, should it ever prove all that is claimed for it, because their industry is still in its infancy, the question appears of sufficient interest to arrest attention.

WALLACE S. JONES,
Consul-General.

Rome, October 9, 1893.

On inquiry at the Chemical Society it was found that nothing was known of the new process amongst chemists in this country. Dr. Hugo Müller, F.R.S., who kindly promised to make further inquiries in Germany, remarked in a letter:—"Citric acid being rather prone to "suffer breaking up in the presence of certain ferments, it is certainly "very remarkable that it should be formed in the process of a special "fermentation action on a sugar in so large a proportion as stated in "the report."

He subsequently obtained and transmitted to Kew an extract from the *Sitzungsberichte der Königlich Preussischen Akademie der Wissenschaften zu Berlin*, which fully confirms "what was stated in the Consular Report."

A condensed translation of the paper is given below. The original was communicated to the Berlin Academy on June 15th last. The process is already being carried out on a commercial scale.

ON CITRIC ACID FERMENTATION.

By Dr. C. WEHMER, of Hanover (communicated by Herr Fischer).

Hyphomycetæ are, as well as other fungi, able to effect fermentations under certain circumstances. A process of this kind, by which as much as one-half of the sugar used is converted into oxalic acid, is well known. I made this process, hitherto the only acid fermentation induced by *Hyphomycetæ*, the subject of a more elaborate investigation.

Further research has brought to light another case similar to oxalic acid fermentation in many ways, the product of which is another organic acid not hitherto obtained under such conditions. I call it "citric acid fermentation."

Certain moulds possess the property of converting a considerable proportion of the sugar contained in the nutritive solution into an organic acid which is, in constitution and properties, identical with that found in lemons, and can be obtained easily and abundantly in well-formed crystals. The nutritive solution becomes very acid after a little time, and the amount reaches 5 per cent. and more. Experiments on a larger scale yielded the acid in such considerable quantities that the commercial application of the method promises to be successful.*

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* "Orange and lemon culture in Sicily." (Consular Reports, No. 102, p. 296.)

The fungi which effect the fermentation are microscopically hardly to be distinguished from the well known *Penicillium glaucum.* They form densely interwoven green films of so energetic a growth as to spread over the largest surfaces in a few days' time. Compared with *Penicillium* they are distinguished, amongst other things, by the structure of the conidiophores; otherwise they are closely allied to it, though the discussion of their systematic position must be deferred owing to our incomplete knowledge of their development.

The more exact examination of the two very similar species proved that they were hitherto undescribed. It was not possible to refer them to the genera *Penicillium*, *Eurotium*, or *Aspergillus*, as they are defined at present. Thus the creation of a new genus was expedient, and I propose the name "*Citromyces*" for it. I call the more completely known species, to which a third will probably be added, *Citromyces pfefferianus* and *Citromyces glaber.*

The spores of these fungi are found to be rather common in the air. Placed on suitable substrata they soon develop into white tufts, which, however, are usually soon overgrown by other species (*Penicillium*); hence it is somewhat difficult to obtain pure cultivations. They may be often met with on fluids containing sugar, or on fruits, particularly acid ones.

I may briefly point out a few details relating to the process of acidification in respect to the development of the fungus, the substratum, temperature, and supply of oxygen.

Solutions of sugar containing the necessary nutritive material present the most favourable conditions for its growth, as well as for the formation of the acid; both, however, are independent of each other, though their optima of temperature approximately coincide.

But the formation of acid can take place beyond the maximum of growth, whilst, on the other hand, the growth of the fungus can proceed without the formation of acid. Temperature is a condition as important to the process as the chemical constitution of the substratum and the presence of sufficient oxygen; for it is not the limited access of oxygen which induces the accumulation of acid. It is not, however, possible at present to be certain whether the carbonic acid set free does not affect the fungus injuriously; there are indications that it does. At all events, absence of air soon brings the vital phenomena to a standstill, and in an atmosphere of carbonic acid neither germination of conidia nor any further development takes place. Light, however, is of no importance; germination, growth, formation of conidia, and acidification take place at an unaltered rate in absolute darkness.

Although citric acid, when present in quantities of several per cents., is rather beneficial than otherwise to the growth of the fungus, which can endure as much as 10–20 per cent., the presence of inorganic acids on the other hand is extremely injurious, and they restrict the growth of the mycelium to a very slow rate, even when present in mere traces.

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* Artificial citric acid is already produced on a large scale and by a method based upon what is stated here, by the "*Fabriques de Produits Chimiques de Thann et de Mulhouse*" at Thann in Elsass.

As in other well-known cases of fermentation, a further production of acid may be obtained by precipitating that already formed. Thus, it is easy to convert as much as one-half of the sugar used into acid; 30 grammes of dextrose yielded about 16 grammes of acid. By this means, the conversion is also accelerated, and the breaking-up of the sugar, with which the formation of acid is evidently closely connected, proceeds more rapidly. Other agents may also act in a similar way, as for instance, the presence of saline compounds of chlorine, &c. The formation of acid continues as long as there is any vitality in the fungus film and available material in the liquid. The acid, however, which is found in the fermenting fluid at a given time, is the residue which results from the two parallel processes of acid formation and acid destruction; the latter eventually prevails, and finally every trace disappears in older cultivations. The destruction of the acid by the fungus is easy to prove by experiment.

By precipitating the acid in the form of a stable salt we eliminate the destructive agency, and favour, at the same time, the causes which favour the accumulation of the acid; this method gives a more exact idea of the process of acidification. It is found to be by no means continuous and uniform at different times, but its rate describes a rather suddenly ascending and descending curve, which is in close relation to the amount of the conversion of sugar effected by the growing fungus.

The formation of the acid proceeds most actively at the time of maximum vitality of the fungus-film; it increases *before* and decreases *after* this period.

I may point to the rather interesting comparison with the production of oxalic acid. In this, favourable conditions of fungus growth (heat and presence of chlorine compounds) promote the rapid destruction of the acid, and prevents its accumulation in the cultivations. Under similar conditions the production of citric acid is not only not checked, but even advanced. The difference may perhaps depend on the lesser capacity of citric acid for being oxidised.

The comparison is important also in other respects. As much as one-half of the sugar consumed can be converted into oxalic acid without impairing the fungus growth. In the production of citric acid, the withdrawal of very considerable quantities of this acid has actually no demonstrable influence on the development of the fungus. We must therefore regard the citric acid as a product of metabolism, to which the fungus is comparatively indifferent. It is, however, evident that when with a given production of fungus material one-half of the consumed sugar is precipitated as citric acid, the other accessory product must decrease in quantity. In this instance this is the carbonic acid into which also under other conditions part of the citric acid is converted. The question now is whether the relation is a *direct* one. On the whole, I should, taking into consideration the observations of O. Warburg on *Crassulaceae*, rather prefer this view to other hypotheses. The breaking up of the sugar molecule results in a great deal of the citric acid produced, besides perhaps other compounds, yielding ultimately carbonic acid as a product of oxidation. Although we may thus consider the acid actually liberated as an intermediate product of metabolism, we leave the question of its constant presence with our fungi undecided, though possible. I may mention by the way that oxalic acid occasionally appears in the fermentative process. But there is no necessity to trace back the totality of the material broken up by metabolism, especially the whole of the carbonic acid derived from respiration, to molecules of organised living substance.

A closer study of the metabolism in this direction might throw light on the process of respiration; for mere determination of carbonic acid without considering other conditions cannot naturally explain it.

Finally, I must point to the constitution of citric acid as having an important bearing on the theory of these fermentative processes. It is clear that it cannot be regarded as a direct product of sugar-oxidation.

[Published June 22.]

It is an interesting coincidence that the *Sugar-cane* for February discusses (pp. 67-70) the occurrence of "*Citric Acid in Cane Juice.*" The acid appears under some circumstances to make its appearance in the process of sugar manufacture. The following is the most important portion of the account of the matter given (p. 69) in a letter from Mr. Edmund C. Shorey, of Kohala (Hawaiian Islands).

"An examination of the organic matter showed that the chief constituent was citric acid, and this combined with lime as calcium citrate formed the body of the scale. I have by decomposing the scale with sulphuric acid, forming sulphate of lime and setting free the citric acid, filtering and evaporating, obtained quite large crystals of citric acid. There are several other organic acids present, the nature of which I have not yet determined, but the citric acid predominates and is the one that gives most trouble owing to the property of calcium citrate being more soluble in cold than in hot water, and consequently of being precipitated from a boiling solution. Unless most of the calcium citrate is precipitated in the triple effet it will be in the vacuum pan, and going into the first molasses make trouble with the second sugar. Here it shows itself as a fine grain or cloud, much like "false grain" in appearance, and having the same effect in centrifugaling, preventing the purging of molasses. A strike of No. 2, which cannot be dried owing to the presence of calcium citrate, will generally dry when cold, enough of the calcium citrate having entered into solution to allow the molasses to go free. I have seen this citrate of lime present in No. 2 sugar to the extent of three or four per cent., and of course lowering the polarisation that much. Its presence can be determined by dissolving a quantity of the sugar in water, and allowing the solution to stand a few hours, when the citrate of lime will settle to the bottom as a fine white powder."

Citric acid also makes its appearance in the manufacture of Sorghum sugar (pp. 69, 70).

"Mr. Oma Carr, of the United States Department of Agriculture, has recently examined a scale or deposit from the Sorghum sugar house at Medicine Lodge.

* * * *

"Except in the proportions of lime and magnesia this is not unlike the scale I have been considering, and the similarity extends to the organic matter, Mr. Carr having found that in this case citric acid was the predominant organic acid.

"I do not consider citric acid a normal constituent of cane juice as ordinarily found in Hawaii, and whether in this case its presence is due to the extremely dry weather or to the fact that the cane is green I cannot tell. An examination of green cane juice during a wet season would throw some light on the question."

There are two possible explanations of this interesting observation. One is, that the citric acid ferment, which is probably ubiquitous, may have got access to the cane juice in the early stages of sugar manufacture. The other is that the tissues of the sugar-cane may under certain cases act themselves as a citric acid ferment, just as Pasteur has shown that in the absence of oxygen alcohol may be produced in fruits and without the intervention of yeast.

Such an occurrence would seem to be accidental and only occasional in the sugar-cane, while in the lemon it would be the normal state of things. In any case the real result seems to be that citric acid in the plant is the result of a ferment action on sugar and not, as Liebig thought, a stage in its building-up.

Dr. Hugo Müller further states that, according to a private communication, the experiments already carried out on a manufacturing scale foreshadow the possibility that citric acid may eventually be produced cheap enough to replace tartaric acid in most of its applications.

CCCLXX.—MISCELLANEOUS NOTES.

Mr. F. M. Bailey, F.L.S., the abolition of whose post by the Government of Queensland was recorded in the *Kew Bulletin* for December last (p. 366), has been re-appointed Colonial Botanist.

The Veitch Memorial Medal.—The Trustees of the Veitch Memorial Fund have this year awarded a medal to Mr. G. Nicholson, A.L.S., Curator of the Royal Gardens, "in recognition of his valuable labours in the preparation of the Dictionary of Gardening, &c." A similar medal was awarded in 1892 to Mr. W. Watson, the Assistant Curator, "in recognition of his skill as a hybridiser and cultivator of exotic plants."

Timbaran Tree of N.E. Borneo.—In some notes in the *British North Borneo Herald* for May 1st, 1893, it is stated that "most of the women "(of the Hill tribes) wear a loose blouse of blue cloth, with a cape of "undyed (brown) *timbaran* bark, the hood of which covers the head like "a poke bonnet, a girdle of cloth or twisted bark ornamented with brass "or silver rings completes the costume. The only covering used by the "men is a scanty fragment of bark."

As the name *Timbaran* was unknown in the Museum in connexion with any Bornean product, though from the fact of the bark being used for clothing it was strongly suspected to belong to a species of *Artocarpus*, application was made to the Secretary of the British North Borneo Company, 15, Leadenhall Street, asking him to be good enough to obtain from some of the Company's representatives in Borneo for the Museum of the Royal Gardens, specimens of the bark in its natural and prepared states, as well as a garment made from the bark, and samples of the foliage, flowers, and fruit to assist in the determination of the species. In response to this application specimens have been received from Governor Creagh, C.M.G., enclosing a copy of a letter addressed to him by Mr. P. F. Wise, dated Papar, September 20th, 1893, from which the following extracts are taken :—

"It is difficult to get good specimens of a coat and of fruit and flowers without going into the interior oneself to get them. The flower I have been unable to get. The tree from which the bark is taken is a species of *tarap*, and to an inexperienced eye cannot be distinguished from that fruit tree. There are three kinds from which bark can be used, the best being that found growing in the hills. The fruit of the tree from which inferior bark is obtained is larger and is used by natives as a vegetable. The fruit which I send is from the tree giving the best quality bark. The leaves from a young tree are upwards of 2 feet long and have points on them very much like a fig-leaf, but larger. When they are old they lose the shape and become rounder, smaller, and with plain edges, as in specimen sent herewith. I tried to press some of the larger leaves, but they got too dry in transit; I send, however, a piece of one partially pressed which will show the shape. I saw the two different shaped leaves on the same tree, the large leaves on a young shoot growing from the trunk and the smaller leaves on the branches above. I have noticed the same thing in the *tarap* tree.

" The *timbaran* tree is, I believe, a species of *Artocarpus*, and I recollect that Sir Hugh Low, in his book ' Sarawak, its inhabitants and productions' (London 1848), mentions some of the tribes wearing clothes made of bark from a species of *Artocarpus*, which no doubt was the *timbaran* tree.

"If I am again in the interior I could obtain better specimens, but send these meanwhile."

From the specimens received at Kew it has been possible to identify the plant, furnishing *timbaran* bark as being very near to *Artocarpus elastica*, Reinw.

Dr. Stapf, to whom the specimens have been referred, thus reports upon them :—

"The large leaf is, in my opinion, identical with two small leaves of a similar shape collected by F. W. Burbidge in North Borneo, one of which has a label attached with the following note ' *Artocarpus*, leaf of ' tree affording tough bark cloth and fibres for cordage, &c., Labuan and ' Borneo.' These two specimens are named *Artocarpus elastica*, Reinw., and agree perfectly with the specimens named thus from De Vriese's herbarium. They belong evidently to the same plant of which Burbidge states in his book ' The Gardens of the Sun,' p. 155, tough bark cloth is made by the natives on the Limbang and the Lawas and the Tampassek River. He calls the cloth ' *Chawat*,' a name which is also attached to one of the specimens of bark cloth in the Museum.

" *A. elastica*, however, is a very doubtful species described from leaves and male inflorescences only. The branch having entire leaves, and the fruit approach on the other hand very closely to those of *A. Blumei*, Tréc (=*A. pubescens*, Bl. not Willd.) which I believe to be identical with *A. Künstleri*, King, a species distributed widely throughout West Malaya, and in the Philippines. *A. Blumei* is mentioned also by Burbidge (l. c., pp. 256, 294), and he gives ' *tarippe* ' as its vernacular name with the Dusuns, evidently another form of spelling of ' *tarap* ' in Mr. Wise's report.

" The only difference between *A. Blumei* and the *timbaran* tree is in the fruit which is globose in the latter instead of oblong, and in the direction of the ' apices of the anthocarps ' which are generally curved upwards instead of reflexed, a very slight difference indeed.

" It appears from Mr. Wise's report that both forms of leaves may occur on the same tree, a statement which is perfectly in accord with a note by Motley concerning another closely allied species from Borneo. It would seem then, that the two *forms* of *A. Blumei* have been described as two different *species*, *A. elastica* referring to the form with lobed leaves and *A. Blumei* to that with entire leaves, which suggestion is, moreover, supported by the fact that Reinwardt gives ' *terap* ' (*truep* in Blume's Bijdr.) as the native name of *A. elastica*, and that

Dr. King indicates a similar dimorphism of the leaves for his *A. Künsteri*. If my assumption be correct *A. elastica,* Reinw., ex Bl. Bijdr. 1825), is the name to be used for the '*tarap*' tree of which the *timbaran* is probably a variety."

New Zealand contributions to Museum.—The Rev. W. Colenso, M.A., F.R.S., F.L.S., of Napier, New Zealand, to whom the Museum of the Royal Gardens is indebted for many valuable contributions extending over a long series of years, has recently sent an interesting illustration of ancient Maori use in the form of a dish some 10 inches long and 8 inches broad, made of the bark of the Totara (*Podocarpus Totara,* A. Cunn.). The outer bark is partially scraped away and the remainder very evenly bent or curved into a boat-shaped form, the ends being folded and brought together, and neatly tied. These dishes were used by the Maoris for filling with water and placing in the tops of trees to entice pigeons who came to drink, when a spear, which had been previously arranged in the tree, was suddenly let loose, piercing and killing the bird. Mr. Colenso, in a paper on "Reminiscences of the ancient Maoris," published in the *Transactions of the New Zealand Institute,* vol. xxiv., 1891, p. 451, describing the use of these dishes says: "I may "here mention that I have seen these totara-bark dishes with water in "them fixed high up on the big branches of trees in the woods in the "Urewera country, having flax nooses so set over the water as to catch "and hold fast the pigeon in its drinking. I have seen pigeons so caught, "the Maoris climbing the trees naked with the agility of monkeys to "secure their prizes."

Another contribution to the Kew collection, made by Mr. Colenso, is a belt made of the long orange-yellow leaves of the Pingao (*Dromoschœnus spiralis,* Hook, f.), a spreading, seaside cyperaceous plant, which is said to be extremely strong and durable. This is also referred to at p. 465 of Mr. Colenso's paper before mentioned.

The Sandalwood of Juan Fernandez.—It is a matter of history that this island formerly abounded in sandalwood of some kind, and Gay (*Flora Chilena,* v., p. 326), although he apparently had no specimens from Juan Fernandez itself, refers it without doubt to *Santalum album,* L. Yet he goes on to say that it was formerly abundant in the island, but had all perished in one year, and only dead trunks were to be found: just as happened to the plane tree in England in the eighteenth century: "En otro tiempo era muy comun en la isla de Juan Fernandez, pero "perecieron todos en un mismo año y hoy no se encuentra sino troncos "muertos; lo mismo sucedió en Inglaterra con el Platano en el siglo 18." F. Philippi (*Catalogus Plantarum Vascularium Chilensium* (1881), p. 261), states that wood having the colour and odour of sandalwood occurred in the ground, and that the plant certainly formerly existed there, though no botanist had seen it, and the species was altogether unknown: "In insula Juan Fernandez lignum vetustum in terra in-"venitur coloris et odoris Santali, et planta verosimiliter adhuc exstat, "sed cum a nullo botanico visa sit, species omnino incognita est."

But there are now irrefragable proofs of the continued existence of a kind of sandalwood in the island; and Mr. F. Philippi has published the recent history of this interesting tree in the *Anales del Museo Nacional de Chile,* of which we have only seen a German translation, entitled *Botanische Abhandlungen,* &c., in which the original plates are reproduced. As long ago as 1868 branches, with a few leaves, of a pleasant smelling wood were found amongst some fuel purchased from the inhabitants of the island for the use of one of the ships of the Chilian navy. This was microscopically examined, and identified as sandalwood. In 1888, Mr. F. Philippi succeeded in procuring a small bundle of twigs bearing leaves, and one of them a few young flower-buds. From this material he has made a drawing and description, and published the species under the name of *Santalum fernandezianum*. He finds it most nearly related to *Santalum freycinetianum*, a species inhabiting the Sandwich, Marquesas, and Society Islands; but the differences he adduces do not amount to much when collated with a numerous series of specimens from those islands. However, he hopes to obtain perfect flowers and fruit soon, when he will prepare a more complete account of it. The tree cannot be so rare as might be supposed, for he has lately received more fresh, though barren, branches. The confirmation of the existence of a species of *Santalum* in the island of Juan Fernandez is a fact of the greatest interest in botanical geography, inasmuch as the nearest locality of any member of the genus is in the far away Marquesas, some 3,500 miles to the north-west. With reference to Gay's statement that all the sandalwood trees of Juan Fernandez perished in one year, Mr. Philippi says that he has not the slightest idea where Gay obtained his information.

Turkey-oak in South Africa.—The introduction of the Turkey Oak, *Quercus Cerris*, into South Africa by means of annual supplies of acorns from the Royal Gardens, Kew, is now an accomplished fact. In 1886 Mr. D. E. Hutchins, Conservator of Forests in the Eastern Division wrote that "Up to the present day, while the seeds of a great "variety of valuable exotic timbers have been sown in the forest "nurseries, we are still without *Q. Cerris*." This tree Mr. Hutchins recommended on account of its being "better adapted to the climate of "the Cape than the common oak, *Q. pedunculata*." Arrangements were consequently made for the annual collection and despatch of the acorns of this oak, ripened at Kew, to the Cape Colony, and altogether about 30 bushels have been forwarded. They were packed partly in casks in water and partly in boxes in moist cocoa-nut fibre refuse, the latter method proving most successful. All acorns soon lose their vitality if allowed to get dry, but if packed in moist soil or sawdust, or cocoa-nut fibre refuse, they may be sent long distances with safety. The last consignment of acorns to the Cape consisted of 10 bushels; they were packed in three boxes, and despatched on October 17th last. According to a report just received one of the boxes became heated on the way and many of the acorns consequently perished, but the acorns in the other two boxes were sound and just beginning to sprout.

The timber of the Turkey oak is held in this country in little esteem. The object in view in growing the tree in the forest reserves of South Africa is explained in the accompanying correspondence.

AGENT-GENERAL FOR THE CAPE OF GOOD HOPE to ROYAL GARDENS, KEW.

ACORNS OF TURKEY OAK.

7, Albert Mansions, Victoria Street, S.W.
October 20, 1887.

SIR,

IN forwarding, for your information, copy of a letter, dated 18th September 1887, No. A., from Mr. D. E. Hutchins, Conservator of Forests, Eastern Division, in the Colony, I have the honour to request that you will be so good as to assist me to carry out the wishes therein expressed, and in so doing confer a great favour on the Colonial Government.

I am informed that Mr. Hutchins has been requested to furnish a report upon the successful results attained with the acorns previously supplied, which will doubtless be forwarded in due course to the Royal Gardens at Kew.

With apologies for thus troubling you,

I am, &c.,
W. T. Thiselton-Dyer, Esq., (Signed) CHARLES MILLS.
Royal Gardens, Kew.

CONSERVATOR OF FORESTS, King Williamstown, to ASSISTANT COMMISSIONER OF CROWN LANDS AND PUBLIC WORKS.

SIR, 18th September 1887.

WITH reference to correspondence regarding the success of the acorns of *Quercus Cerris* received from Kew nine months ago, and the difficulty of obtaining these acorns elsewhere, I have the honour to suggest that the Kew authorities be addressed with the view of allowing us to have their acorns again this year, and annually for the future.

The great importance of growing oaks in these forests is that they are trees which by their dense shade keep down the grass, the burning of which does so much damage to the forests every winter.

The Turkey oak being better adapted to the climate of this country than the common oak, *Quercus pedunculata*, its extended propagation is of the first importance.

I have, &c.
(Signed) D. E. HUTCHINS,
Conservator of Forests,
Eastern Division.

The Assistant Commissioner of
Crown Lands and Public Works.

Errata.—For "cym laterali axillaria" (*Kew Bulletin*, No. 85, p. 31, second line from bottom), read "cyma laterali axillari."

For "Agyreia," (4th and 20th lines p. 67, *Kew Bulletin*, No. 86). read "Argyreia."

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 88.] APRIL. [1894.

CCCLXXI.—WEST INDIAN LIME.

(*Citrus Medica*, L., var. *acida*, Brandis.)

(With Plate.)

One of the most distinct species of *Citrus* is *C. Medica*, which includes the citron, lemon, and the limes. Of the limes there are sweet and sour limes, characterised, according to Roxburgh, by small pinkish flowers, usually four petals, and a perfectly spherical fruit, having a thin skin of a lively yellow colour and pale acid juice. Sir Joseph Hooker states that the word lime is promiscuously applied to fruits very different in character, especially in British India, where the sweet limes of various forms are universally spoken of under that name.

The sour lime, although probably introduced from the East Indies, has made its second home in the West Indies, where, indeed, is its present principal area of systematic cultivation. The history of the sour lime is given by Sir Joseph Hooker in the *Botanical Magazine*, tab. 6745. It was first described by Rumph (*Hortus Amboinensis*, ii, p. 107, tab. 29) in 1750, under the name of *Limonellus*, alias *Limotenuis*, or thin-skinned lemon. *C. Limonellus* is also described by Miquel, who says it is cultivated everywhere in the Dutch East Indies. The same plant is well-figured by Wight as *C. Limetta*, Risso (*Icones*, t. 958), who says it is wild in the Nilgiris. In the West Indies, McFadyen very clearly describes it as *Citrus Lima*, "a thorny shrub with ovate "leaves, pentamerous white flowers, small nearly globose yellow fruit, "with thin skin, and an abundance of pure acid juice; it is naturalised "in Jamaica, forming strong fences." Brandis (*Forest Flora*, Ind., p. 52) rightly places the sour lime of India as a variety of *Citrus Medica*, L.; other authors refer the sour or West Indian lime to *C. Limetta*, Risso, its nearest European representative, but this latter differs in its sweet juice. The botanical position of the West Indian lime as an acid variety of *Citrus Medica*, L., is now established. This small acid lime seems confined to tropical and sub-tropical zones. It does not appear to flourish in Southern Europe, and as already stated, its present head-quarters under cultivation are in the West Indies, where in the islands of Montserrat, Dominica, and Jamaica it is commercially utilised for the production of lime juice and essential oil.

The lime, as already mentioned, yields juice of a singularly pure, acid flavour. The fresh limes are sometimes exported as gathered, or they are pickled in sea water or brine and shipped to the United States. The demand for the fruit in a fresh or pickled state is said to be very limited. Sir Joseph Hooker states :—"The lime is a favourite fruit in "the West Indies and the Southern United States, the acid being far "more grateful than that of the lemon; and it is, hence, universally "used for flavouring soups, &c. and in the preparation of many alcoholic "and acidulated drinks. In my younger days it was imported in vast "quantities into the City of Glasgow, providing an indispensable "material for the brewing of the famous Glasgow punch. That it is "now so seldom seen, comparatively, is due to the declension of that "social and family intercourse that once was so intimate between the "great city and the Spanish main. It is still (with the lemon) the "principal source of citric acid."

Lime juice is obtained by compressing the fresh ripe fruits between heavy rollers. This is exported in the raw state or concentrated. The latter is obtained by evaporating the raw juice in copper or enamelled iron pans until it is reduced to about one-eighth or one-tenth of the original bulk. When exported it is a dark, viscid fluid of the consistence of treacle. The concentrated lime juice is not used for food purposes but devoted entirely to the preparation of citric acid largely in demand by calico printers. From the rind of the fresh fruits there is obtained by a hand process, called "ecuelling," a fine essence of limes exported in copper vessels. A description, with an account of the mode of using the *ecuelle* (a specimen of which was presented to Kew by Mr. Joseph Sturge, Managing Director of the Montserrat Company in 1892), is given in the *Kew Bulletin*, 1892, pp. 107, 108. The ecuelle is a copper basin furnished on the inside with numerous prominent studs. The instrument is held in the left hand while the fruit, taken singly, is gently rubbed with a circular motion on the studs. This action bruises the oil glands in the rind and the oil flows in small quantities to the bottom of the basin. The process is a slow one and is performed in the West Indies by women and girls. The task per day is measured in fluid ounces. By distilling the raw lime juice a spirit is obtained known as oil of limes. The essence of limes extracted by hand is far more valuable than the oil of limes. The perfume of the latter is injuriously affected by the heat necessary in distillation.

The following notice of the lime tree in the West Indies is taken from a paper on "Planting Enterprise in the West Indies," by Mr. D. Morris, C.M.G., F.L.S., read before the Royal Colonial Institute. 12th June 1883 :—

"The lime tree, a member of the Citrus family, grows well in all the West Indian Islands. It requires a light, loamy, and somewhat stony soil, and an elevation, depending upon latitude, from sea-level up to 500 feet. The trees are planted at 15 feet apart, giving about 200 trees per acre. They come into bearing in about six or seven years, but light crops are often gathered from trees at five years. To ensure large and permanent crops, the trees require to be regularly pruned, and to be kept free from all parasitic growths, such as species of *Loranthus*, &c. They are also greatly benefited by tillage, that is, loosening of the soil around the roots, and being kept free from grass and weeds.

"The annual mean temperature of Montserrat at sea-level is given at 78° F., and the annual rainfall at 59 inches. These conditions are evidently those most suitable for the successful cultivation of lime trees, for at Montserrat the lime orchards present a most beautiful sight.

"With regard to the manufacture and preparation of lime juice, I cannot do better than quote the following from an interesting article on 'Lime juice: its Properties and Uses,' by Mr. Michael Conroy, F.C.S. published in the *Pharmaceutical Journal* [3], xiii. 606:—

"'In Montserrat the lime fruit harvest is heaviest from September to January, but a good supply of fruit is yielded throughout the whole year. Here, where the lime tree is specially cultivated for the sake of the juice, the work is done in a systematic manner with suitable machinery. The fruit, after collection, is taken to two central factories, where it is sliced by water power, and then squeezed in huge wooden presses, the juice being run into puncheons, and quickly bunged up. This is a most important point in preparing the juice in a tropical climate, for if exposed, it would rapidly decompose. I am also informed that the choicest fruit is alone used, and that only about two-thirds of the juice is pressed out, thus ensuring greater freedom from mucilaginous and pulpy matter. The further pressings, together with the juice of unsound fruit, is evaporated to the consistence of treacle, and sent over to this country for the manufacture of citric acid.'"

An account of the "Lime Industry in Dominica" was contributed by Dr. H. A. Alford Nicholls, F.L.S., to the Demerara *Timehri*, vol. ii., pt. 1. Atwood, the historian of Dominica, speaks of the lime trees as existing in that island in 1791, "that the fruit of both (lemon and "lime) is in great abundance, large and of excellent quality, of these, "the latter especially, great quantities are often sent in barrels to "England and America. The neighbouring English islands are "likewise often supplied with them from this country, especially those "of Antigua and Barbados."

Dr. Nicholls continues: "To Dr. Imray belongs the honour of the "origination of the new lime cultivation; but I must mention that soon "after this public benefactor had established the lime groves in Dominica "the Messrs. Sturge, quite independently and without any knowledge "of Dr. Imray's experiments, set to work to establish similar cultivation in Montserrat."

Details respecting the cultivation and the preparation of lime juice are fully given by Dr. Nicholls in his recent work—*Tropical Agriculture* (London: Macmillan), p. 153.

The following further information respecting the lime industry at Dominica is taken from a paper by Mr. Morris "On the Colony of the Leeward Islands," read before the Royal Colonial Institute, on April 14, 1891:—

"Another very promising industry for Dominica is the production of lime juice. This is obtained from a thin-skinned variety of the citron, known as the West Indian lime (*Citrus Medica*, var. *acida*). This particular variety is apparently more widely spread in the West Indies than in any other part of the world. The lime-juice industry in Dominica was greatly encouraged, if not actually started, by the late Dr. Imray. In 1870 the value of the lime juice exported was 83*l.*; in 1874 it had risen to 1,600*l.*; in 1889 it had increased to 8,061*l.* Dominica limes are large and very juicy. The trees are the healthiest I have seen in the West Indies, and, within such limits as are imposed by the commercial demand for the produce, it deserves to be largely extended.

"A carefully compiled return was prepared for me by a lime planter in Dominica, which I read and submitted for criticism at a public meeting held at the Court House in Roseau on December 9th, last. I am unable to publish this in full, but I will give a brief summary of it. It appears that it takes about 1,000*l.* to purchase and establish 20 acres of good land with lime trees, to build a house for the manager, to erect a mill, with copper boilers to concentrate the juice, to pay for superintendence, and cover all expenses for seven years. At the end of this time the estate would yield at the rate of 40 hogsheads of concentrated lime juice, worth 12*l.* per hogshead. This would amount to a gross income of 480*l.* The yearly cost of cultivation and manufacture (including the cost of providing the hogsheads) would amount to 240*l.* There would, therefore, remain exactly 240*l.*; and this sum would be the net income of a lime estate which had cost 1,000*l.*, spread over seven years."

A recent and somewhat full account of the lime industry at Montserrat and Dominica is given by Mr. Consul Galbraith in the United States Consular Reports, December, 1892, pp. 519–522. As these reports are not easily accessible in this country the following brief summary is given on points not already touched upon:—The area under lime cultivation at Montserrat in 1892, is estimated at "1,200 acres, of "which about 900 acres are in fruit-bearing trees." The orchards in Dominica are smaller, and with one or two exceptions, the same care is not exercised in the cultivation of the trees, nor in the manufacture of the juice. "The largest crops are gathered in years in which the "rainfall is heaviest. The average yield of fruit from an orchard in "full bearing would be about 60 to 80 barrels (an ordinary flour "barrel is employed in all orchards to gauge the quantity of fruit) "from an acre per annum. . . . . A barrel of fruit will yield "from six to seven gallons of juice, and each gallon of sound ripe juice "contains from 12 to 15 ounces of citric acid." Raw lime juice is preserved in casks and shipped chiefly to the London market. The manufacture of concentrated lime juice consists in boiling the juice in open pans until reduced to about one-tenth of its volume; "it is then a "black viscid fluid containing from 80 to 100 ounces of citric acid per "gallon. . . . Concentrated lime juice is principally shipped to "the New York Market."

Green limes are exported to a small extent only, and to the English market. Pickled limes, in salt water or brine, are invariably sent to Boston. "The average shipments of products of the lime tree from "Montserrat for the last five years, were as follows: Raw lime juice, "800 puncheons of 120 gallons each; concentrated lime juice, 200 "casks of 54 gallons each; green limes, 1,000 boxes; pickled limes, 300 barrels; essential oil, 2,500 pounds."

Living specimens of the West Indian Lime are in the Kew collections, obtained from the Montserrat Court at the Colonial and Indian Exhibition, 1886. A plant of a small lime called the Bijou Lime (*Citrus Medica*, var. *Riversii*) is figured and described by Sir Joseph Hooker in the *Botanical Magazine*, tab. 6807. This differs from the West Indian Lime in the few spines, the elliptic smoother leaves, with very numerous, parallel, regularly placed nerves, the wingless petioles, and in the smaller and more globose higher coloured fruit, which has a distinctly bitter flavour superadded to the acid; the peel too is not so fragrant.

EXPLANATION OF PLATE.

WEST INDIAN LIME (*Citrus Medica* var. *acida*).

Fig. 1, Flowering branch; 2, Transverse section of fruit—*both of the natural size.* 3. Glands of the rind—*enlarged.*

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CCCLXXII.—JAFFA ORANGE.

Of the history of this orange apparently very little is known. It is an egg-shaped orange, of large size, and a recent introduction to this country, where it is esteemed as a dessert fruit chiefly on account of its size, colour, and uncommon shape. It is called the Jaffa orange because so far it is received only from Jaffa, where, however, other varieties of oranges are grown, but perhaps not so largely exported as the egg-shaped sort. Evidently a similar orange is known in Malta. In a Report on the Fruits of Malta, prepared by the late Dr. Gulia, Director of the Botanic Garden (*Kew Bulletin*, 1888, p. 237), amongst the sweet oranges grown in the island is a variety described as follows:—" The egg-shaped or oblong orange (*laring tauuali*) forms a very " lucrative production for the Maltese gardener. The fruit is large, " oblong, rind thickish, pulp containing an agreeable juice, seeds few. " It is the most perfect of our oranges, and really forms a handsome " dessert fruit. It is extensively grown for export, and sold from 4*d*. " to 1*s*. 3*d*. per dozen." According to the *Histoire et Culture des Orangers, par A. Risso et A. Poiteau*, Paris, ed. 1872 (Du Breuil), this egg-shaped orange is apparently not known in Southern Europe, or at least it is not figured in this important work amongst the cultivated oranges of that part of the world. In Sicily " oranges of two " kinds are described, the oval and the round. The trees that bear the " oval fruit are preferred . . . . the oval oranges " are in demand in commerce, being more durable." In the U. S. Consular Reports, No. 41½, June 1884, pp. 760, 761, it is mentioned that the oranges in Syria " are distinguished by their shape and contour: " *Belady*, round flat ends, very thick peel, hardy; ripens late. " *Shamonty*, long, like an egg, thin-skinned; ripens early. *Bisry*, " finest flavour; a seedling. All these, except the last, are grafted " upon the wild or bitter orange . . . . Only one " variety [the Bisry] grows directly from the seed."

Judging by the brief particulars here given, the *Shamonty* appears to come nearest to the Jaffa orange as known in this country.

The Maltese oval orange, already regarded as probably identical with the egg-shaped "Jaffa" orange, has been introduced to Florida. In a Report on the Condition of "Tropical and Sub-Tropical Fruits in the United States in 1887," U. S. Department of Agriculture, Washington, 1888, p. 66, the following particulars are given:—

"*Maltese Oval.*—From the Mediterranean. Imported by General Sanford. Thornless, rapid grower, very prolific; fruit oval in shape and of a beautiful orange colour, medium in size, and bears transportation unusually well. Of some 20 boxes shipped to England last winter there were only 10 oranges spoiled on arrival in the lot. This variety is a special favourite in the London market. It is probably more largely planted in Orange County [Florida] than any other kind."

A Maltese "oval" orange is enumerated amongst the fruits cultivated in South Australia. Again, a "St. Michael's egg" orange grown in Florida evidently approaches the "Maltese oval" in character. It is described as follows: "Large, oval; thick skinned; juicy, but not "rich; quality fair. Tree prolific; few thorns." U. S. Department of Agriculture, Report l.c., p. 71.

The Jaffa orange has been largely imported into the United Kingdom during the last 10 years, and "in colour, shape, and flavour it is a most attractive fruit." In a Foreign Office Consular Report (1884, p. 1,433) it is stated that "perhaps in no part of the world is the orange grown "to greater perfection than in the orchards of Jaffa." In 1883 there were exported to the United Kingdom 11,278 boxes of Jaffa oranges. Since that time the trade has considerably increased, and at the present time the exports have reached 36,000 boxes.

The influence of this increased activity in fruit growing at Jaffa has brought to it a remarkable prosperity. In a Foreign Office Report (Miscellaneous Series, 1893, No. 300) "On Irrigation and Orange Growing at Jaffa," the following particulars are given :—

"Jaffa, the chief town of the Caza of that name, owes its importance to its climate, which is extremely favourable for orange growing. As a natural consequence, this seaport is surrounded on the land side by orange groves, covering an area of some 720 hectares (about 1,780 acres). Jaffa oranges, thanks to their excellent flavour, have of late years acquired a world-wide reputation, and while some 18 years ago this fruit was known only to Beyrout, Alexandria, and Constantinople, enormous quantities of it are now exported to Europe, America, and even to India, and its cultivation has consequently increased to a very considerable extent. A special feature of Jaffa oranges is that they will keep from 30 days to 40 days, and, if properly packed, for two months, and even three months. New orange groves are continually being laid out, and now number some 400, against 200 some 15 years ago. This, again, has influenced the population of Jaffa, which now contains 42,000 inhabitants, against 15,000 inhabitants some 12 years ago. The revenues have doubled, and the vicinity of the custom-house is crowded with piles of cases of oranges waiting shipment to all parts of the world. The Imperial Ottoman Government, with a view to encourage the export of oranges, levies an export duty of only 1 per cent. on them, and the exports for the last few years have averaged 36,000 boxes per annum. Owing principally to the trade in oranges, Jaffa now ranks next after Beyrout in importance among Syrian coast towns." . . .

"Orange growing in Syria is conducted exclusively by natives. Each orange garden contains some 2,000 square feet of planted area, equal to about 1,300 trees to the hectare (= 2·471143 acres). The trees begin to bear the fourth year after planting, but it is estimated that it takes seven years, and sometimes eight years, before an orange orchard yields a remunerative crop. During all this time, and even afterwards, the orchards have to be watered continually, and this irrigation is the most difficult and the most labourious part of the work in connexion with orange growing, inasmuch as the water has to be drawn by means of more or less primitive water-wheels from wells dug in the gardens 90 feet and even sometimes 100 feet deep."

The following correspondence has passed between the Foreign Office and Kew in regard to Jaffa oranges :—

FOREIGN OFFICE to ROYAL GARDENS, KEW.

SIR, Foreign Office, May 9, 1889.

I AM directed by the Marquis of Salisbury to transmit to you, to be laid before Mr. Thiselton-Dyer, a letter from Mr. J. H. Whitley asking that information may be procured for him respecting the nature and cultivation of the variety of orange known as "Jaffa" orange; and I am to request that you will move the Director to inform his Lordship whether he is able to furnish any information on the subject.

I am, &c.
(Signed) JAMES FERGUSSON.

The Assistant Director,
Royal Gardens, Kew.

(Enclosure.)

MR. J. H. WHITLEY to FOREIGN OFFICE.

125, Bridge Street, Birkenhead,
May 6, 1889.

SIR,

As a grower, in our Colonies, of oranges, my attention has been drawn to the importation of Jaffa oranges. These are considered of a variety that would improve ours grown in Australia. I am anxious to have some particulars from Jaffa connected with the culture of the trees there, their exact variety, and, if possible, some properly matured and dried pips for seeds.

I am not aware of there being a British Consul there to whom to address myself, I therefore beg to ask for information from the Foreign Office as to the agent of the Government in Jaffa, if one exists, or if not, to whom I could apply for the information desired.

I am, &c.
(Signed) J. HORNER WHITLEY.

The Under Secretary of State,
Foreign Office.

ROYAL GARDENS, KEW, to FOREIGN OFFICE.

SIR,
Royal Gardens, Kew, May 13, 1889.

I AM desired by Mr. Thiselton-Dyer to acknowledge the receipt of your letter of the 9th instant, with inclosure, on the subject of Jaffa oranges.

2. The only informatian bearing upon the cultivation of this variety of orange at present available is contained in the United States Consular Reports, No. 41½, June 1884, pp. 761–762. This information is, however, not entirely confined to Jaffa oranges, but embraces other kinds cultivated in Syria. Information of a general character respecting Jaffa oranges is contained in the Foreign Office Consular Reports, 1884, p. 1433; and 1888 (No. 363), p. 3.

3. Seeds of Jaffa oranges are obtainable from ripe fruits, which may be generally purchased in the season at the larger London shops. As regards the reliability of orange plants raised from seed, an interesting account is given in the *Gardeners' Chronicle*, April 5, 1884, p. 457, of an instance where seeds of St. Michael's oranges, obtained from Covent Garden Market, and grown by Dr. Bennett, at Torre de Grimaldi, Mentone, produced when the plants were twelve years old, fruits "exactly like the best St. Michael's, smooth and thin-skinned, sweet "and juicy."

I have, &c.
(Signed) D. MORRIS

Sir Villiers Lister, K.C.M.G.,
Foreign Office, S.W.

CCCLXXIII.—WEST AFRICAN CINCHONA BARK.

In Messrs. Jenkin & Phillip's Circular of Cinchona Bark Sales in London, dated the 9th January 1894, it is stated that 283 bales of "African" bark were sold at prices varying from 2¼*d.* to 3¼*d.* per pound. This bark was *succirubra* or red bark.

Again, in Messrs. Lewis and Peat's Annual Report, dated 30th January 1892, it is mentioned that of West Coast African bark "766 bales, "weighing 97,000 lbs., chiefly druggists' descriptions have been "offered and sold at from $2\frac{1}{2}$*d.* to 6*d.* per pound."

As inquiry has been made at Kew in regard to the origin of this African Cinchona bark, it may be well to give a brief account of it.

A sample of Cinchona bark grown at the Portuguese island of St. Thomas (São Thomé), in the Gulf of Guinea, West Coast of Africa, was presented to the Museums of the Royal Gardens, Kew, in 1884, by Messrs. Thomas Christy and Co. This sample was accompanied by a return of analysis, giving the following results:—Crystallised quinine, 2·64 : crystallised quinidine, 0·11 ; crystallised cinchonidine, 0·48 ; cinchonine (alkaloid), 4·06 ; amorphous, 1·00.

In February 1884, Mr. H. H. Johnston, C.B., read a paper before the Society of Arts on the Portuguese Colonies of West Africa, and he gave an account of a visit paid to the Quina (Cinchona) plantations in the island of São Thomé (*Journal of the Society of Arts*, XXXII., p. 235). These plantations ascend to about 3,500 feet. Mr. Johnston adds "land is sold for a mere nothing in São Thomé, for only about one "third of the island is under cultivation . . . . The climate on "the uplands is perfectly salubrious."

From a note by C. Tille in Möller's *Deutsche Gartnerzeitung*, No. 13, April 20, 1892, p. 139, it appears that Cinchona of two species is grown at São Thomé, viz., *Cinchona succirubra* and *C. Calisaya*. The estimated number of trees under cultivation is placed at 500,000.

A few Cinchona trees may be also cultivated at the Spanish island of Fernando Po, also in the Gulf of Guinea, off the coast of the Cameroons. Messrs. Lewis & Peat express the opinion "no doubt a portion (of the "Cinchona bark sold in London) does come from Fernando Po, but the "greater portion of it comes from the island of St. Thomas—in fact "'São Thomé' forms a part of the mark on the packages." Messrs. Jenkin & Phillips, with regard to recent parcels, state that "the "cultivated *Cinchona succirubra* bark sold at public sale (1894) was "grown at the island of São Thomé, West Coast of Africa, and we "believe it comes from no other place."

It is evident from the particulars here given that the West African Cinchona bark received in this country is derived solely from cultivated trees, and these have been grown from seeds or plants originally obtained from the home of the Cinchonas in South America. Further, that nearly the whole of this bark, if not the whole, comes from the Portuguese island of São Thomé. We have no evidence that Cinchona is cultivated anywhere on the mainland of the West Coast of Africa.

CCCLXXIV.—DIAGNOSES AFRICANÆ, III.

APOCYNACEÆ.

Auctore O. STAPF.

110. **Tabernaemontana inconspicua**, *Stapf;* frutex glaber, ramulis gracilibus, foliis obovato-cuneatis vel obovato-oblongis abrupte et longe acuminatis membranaceis nervis lateralibus utrinque 8–10 valde prorsus arcuatis subtus prominulis venis inconspicuis, petiolo gracili, cymis terminalibus paucifloris vel ad florem solitarium reductis in racemis geminatis vel in panicula pauperata, pedunculo brevi, pedicellis subgracilibus, calyce 5-partito lobis ovato-lanceolatis acutis intus basi

multiglandulosis, corollae tubo cylindrico lobis in alabastro eo paulo brevioribus, staminibus infra medium insertis filamentis brevissimis antheris lanceolatis basi rotundatis exappendiculatis, disco nullo, carpellis ovoideis liberis, stylo ovario subaequilongo, stigmate clavato exannulato.

HAB.—Gaboon, Mt. John River, Kongui, *G. Mann*, 1803.

Frutex 10 ped. altus. *Folia* ad 7 poll. longa, 2 poll. lata; *petiolus* 6–8 lin. longus. *Inflorescentia* 1–1¼ poll longa; *pedunculus* ½ poll. longus; *pedicelli* ad 2 lin. longi. *Calyx* ad 1¼ lin. longus; *Corollae* tubus fere 3 lin. longus.

111. **Tabernaemontana dipladeniiflora**, *Stapf;* frutex scandens vel arborescens glaber, ramulis gracilibus pallidis, foliis obovato-oblongis vel ellipticis breviter acuminatis acumine acuto vel obtuso basi subcordatis membranaceis opacis nervis lateralibus utrinque 6–7 obliquis arcuatis venis tenuissimis, petiolo brevissimo vel subnullo, floribus 1–2 terminalibus in ramulis gracilibus cernuis subsessilibus vel pedicellatis bracteatis foliis binis suffultis, calyce 5-sepalo, sepalis e basi subcordata ovato-lanceolatis intus basi multiglandulosis, corollae magnae tubo a basi ad ⅔ anguste cylindrico abhinc late campanulato, lobis e basi cordata ovato-oblongis, staminibus ad dilatationem insertis inclusis filamentis brevissimis latis antheris sagittatis, disco nullo, carpellis basi cohaerentibus caeterum liberis, stylo filiformi longo stigmate clavato (?), ovulis numerosis multiseriatis, carpellis divergentibus elongato-oblique-ovoideis, seminibus (immaturis) ovoideis in pulpa nidulantibus.

HAB.—Gaboon, Munda, Sibange Farm, *Soyaux*, 392, 315.

Folia 6 poll. longa, 2½–3½ poll. lata. *Pedicellus* ad 6 lin. longus. *Calyx* 4 lin. longus. *Corollae tubus* 2½ poll. longus, inferne 1½, superne 6 lin. latus, lobi 1½ poll. longi, ad 1 poll. lati.

A species of very striking habit on account of the almost sessile subcordate leaves and the drooping flowering branches which bear only 2–1 large flowers. They are in one of the two specimens which I have seen supported by two opposite leaves which form a kind of involucre, whilst there is a pair of scars indicating the presence of such leaves at the base of the pedicel in the fruiting specimen. The corolla resembles very much that of some of the large flowered species of *Dipladenia* and *Manderilla*, but the aestivation of the lobes, the shape of the stamens and the stigma are as in *Tabernaemontana*, and it approaches particularly to *T. Barteri*, Benth., and *T. subsessilis*, Benth.

112. **Wrightia parviflora**, *Stapf;* ramis novellis tomentellis vetustioribus castaneis plerumque lenticellis albidis conspersis, foliis oblongis acuminatis basi breviter acutis membranaceis opacis supra glabris subtus minute puberulis vel tomentellis, nervis lateralibus utrinque 7–9 oblique arcuatis subtus prominulis venis tenuissimis, petiolo brevi, cymis in corymbis vel paniculis contractis terminalibus breviter pedunculatis tomentellis, pedicellis gracilibus demum flore sublongioribus, bracteis minutis subulatis, calyce lobis rotundatis in margine membranaceis intus cum glandulis majusculis applanatis alternantibus, corollae tubo e basi leviter ampliata cylindrico minutissime tomentello intus in fauce fimbriis numerosis filiformibus longe exsertis superne crispis instructo lobis ovato-oblongis obtusis, staminibus in parte tertia infima insertis fere ad faucem tubo adnatis abhinc liberis et in conum exsertum convergentibus antice pilis sursum curvatis vestitis, antheris sagittatis, disco tenui, carpellis liberis, stylo filiformi, stigmate disciformi basi membrana reflexa cincto, folliculis longe lineari-lanceolatis glabris striatis.

Hab.—Lagos, *Barter*, 20,170; *Rowland;* Eppah, *Barter*, 3,278; Yoruba, *Millson*.

Folia 2½–4½ poll. longa, 1¼–1¾ poll. lata, *petiolus* 3 lin. longus. *Pedunculus* ½–1¼ poll. longus, *pedicelli* ad 4 lin. longi. *Calyx* ¾ lin. longus. *Corallae* tubus 2 lin. longus, lobi 2 lin. longi.

113. **Zygodia urceolata**, *Stapf;* ramis rufo-tomentosis flexuosis, foliis rhomboideo-lanceolatis utrinque acutis supra lucidulis costa excepta glabris subtus in costa dense cæterum laxe rufo-pilosis, nervis lateralibus tenuibus vel tenuissimis utrinque 6–7 quorum 3 vel 2 plerumque distinctiores, cymis plurifloris valde contractis epedunculatis bracteatis rufo-pubescentibus, pedicellis subnullis, calycis lobis ovatis pubescentibus, corolla urceolata tubo extus glabro intus albo-piloso lobis rotundato-ovatis tubo fere triplo brevioribus erectis, staminibus paulo supra basin insertis faucem attingentibus, filamentis brevissimis antice pilosulis, antheris dorso sub apice penicillo pilorum ornatis, disco annulari distincto, carpellis pilosis, stylo brevissimo stigmate basi conico incrassato.

Hab.—Angola, *Welwitsch*, 5961.

Folia circa 1 poll. longa, ½ poll. lata, *petiolus* ¾ lin. longus. *Calyx* ½ lin. longus. *Corolla* 1¼ lin. longa.

114. **Alafia lucida**, *Stapf;* alte scandens, glaberrima, ramis nigrescentibus, foliis obovatis obtusis basi plus minusve cuneatis supra obscure viridibus lucidis subtus fuscis, nervis lateralibus utrinque 5–6 arcuatim collectis arcubus a margine remotis nervis venisque imprimis subtus prominulis, cymis paucifloris breviter pedunculatis pedunculo pedicellisque gracilibus, calyce 5-partito minuto lobis ovatis ciliolatis intus basi glandulis cum lobis alternantibus instructo, corollae tubo basi sub staminibus paulo angustiore sub fauce constricto et intus annulatim incrassato extus glabro intus ad staminum insertionem piloso, lobis late ovatis ima basi subito contractis ciliolatis, staminibus medio tubo insertis faucem vix attingentibus, carpellis distinctis pubescentibus, stylo superne incrassato, stigmate basi annulatim dilatato.

Hab.—Muni River, *G. Mann*, 1752.

Frutex 40 ped. altus, scandens. *Folia* 2–2½ poll. longa, ad 1¼ poll. lata, *petiolus* circa 2 lin. longus. *Pedunculus* 4–6 lin. longus, *pedicelli* 2 lin. longi. *Calyx* ½–¾ lin. longus. *Corollae* tubus 2 lin. longus, lobi 4–5 lin. longi, ad 2 lin. lati.

115. **Alafia cuneata**, *Stapf;* glaberrima, ramis fusco-nigrescentibus, foliis obovato-cuneatis obtusis vel obscure acuminatis opacis pallidis subcoriaceis, nervis lateralibus utrinque 4–6 valde obliquis arcuatim collectis, nervis venisque imprimis subtus prominulis, petiolo brevi, cymis in corymbis brachiatis multifloris laxis glabris breviter pedunculatis, pedicellis gracilibus longiusculis, calyce parvo lobis ovatis intus cum glandulis majusculis alternantibus, corollae tubo ad medium leviter ampliato abhinc cilindrico sub ima fauce abrupte constricto extus glabro intus sub staminum insertione parce albo-piloso, lobis late ovatis tubo subduplo longioribus, staminibus medio insertis faucem subattingentibus, carpellis liberis pubescentibus stylo superne incrassato stigmate basi annulatim dilatato.

Hab.—Angola, Golungo Alto, 1,000–2,400 ped., *Welwitsch*, 5,953, 5954.

Folia 3 poll longa, 1½–1¾ poll. lata, *petiolus* 2–2½ lin. longus. *Pedunculus* 2–5 lin. longus, *pedicelli* 1½–2½ lin. longi. *Calyx* ¾ lin. longus. *Corollae* tubus ad 2 lin. longus, lobi 3–3¼ lin. longi.

116. **Alafia caudata,** *Stapf;* glaberrima, ramis gracilibus fuscescentibus vel nigrescentibus, foliis ovatis vel oblongis obtuse caudato-acuminatis, basi rotundatis vel breviter acutis supra sublucidis obscure viridibus subtus pallidis membranaceis, nervis lateralibus tenuibus saepe indistinctis utrinque circiter 6 rectis arcuatim collectis arcubus a margine subdistantibus, petiolo brevi, cymis umbellatim contractis 7–2-floris laxis breviter vel brevissime pedunculatis terminalibus (rarissime axillaribus) glabris, pedicellis gracilibus longiusculis calyce parvo 5-partito lobis ovatis cum glandulis alternantibus, corolla tubo cylindrico medio leviter dilatato sub fauce abrupte constricto extus glabro intus ad staminum basin piloso caeterum glabro, lobis late ovatis tubo paulo longioribus, staminibus medio tubo insertis faucem attingentibus, carpellis liberis pubescentibus stylo superne sensim incrassato stigmate basi annulo instructo.

HAB.—Angola, Golungo Alto, 1,000–2,400 ped. *Welwitsch*, 5,955, 5938.

Folia 2½–3½ poll. longa, 1–1½ poll. lata, *petiolus* 1½–2 lin. longus. *Pedunculus* ad 4 lin. longus, *pedicelli* 3½ lin.

117. **Alafia sarmentosa,** *Stapf;* frutex alte scandens sempervirens glaberrimus, ramis sarmentosis longis gracilibus, foliis oblongis obtuse breviterque acuminatis basi acutis vel subrotundatis tenuiter coriaceis sublucidis, petiolo brevi subgracili, cymis in corymbo parvo subsessili ad 12-floro, pedicellis gracilibus brevibus, calyce 5-partito lobis late ovatis obtusis minute ciliolatis intus cum glandulis parvis alternantibus, corollae albae gratissime odorae tubo e basi paulo ampliata cylindrico fauce barbatula sanguinea, lobis ovato-lanceolatis obtusiusculis, staminibus paulo infra medium insertis faucem attingentibus, disco tenuissimo, stylo anguste obconico stigmate ovoideo apiculato.

HAB.—Golungo Alto, Queta Mts. Climbing and rambling in bushes and small trees. *Welwitsch*, 5965.

Folia ad 3½ poll. longa, ad 1¼ poll. alto *petiolus* 2 lin. longus. *Calyx* vix 1 lin. longus. *Corollae tubus* 2 lin. longus, lobi 2½ lin. longi.

118. **Holalafia,** *Stapf.* (Gen. nov.).

Calyx 5-partitus, basi intus 5-glandulosus, lobis inaequalibus obtusis. Corolla hypocrateriformis, tubo cylindraceo ad stamina dilatato, fauce esquamata, intus sub fauce minute puberulo; lobi 5, contorti, lati, obtusi, dextrorsum obtegentes, sinistrorsum torti. Stamina medium versus tubi inclusa, filamentis brevibus pro maxima parte tubo adnatis dense albo-pilosis; antherae lineari-sagittatae, acutae, circa stigma conniventes et ei medio adhaerentes, loculis basi in appendiculas breves acutas productis. Discus nullus. Ovarium integrum, biloculare, pubescens; stylus filiformis; stigma breviter conicum membranula basi annulatum; ovula in quoque loculo numerosa.—Frutex scandens. Folia opposita, penninervia. Cymae dense corymbosae ad apices ramorum breviter pedunculatae. Flores majusculi.

Holalafia multiflora, *Stapf.;* glaberrima, ramis crassiusculis fistulosis fuscescentibus, foliis ellipticis vel oblongis breviter acuminatis basi late rotundatis vel subcordatis supra lucidis subtus opacis membranaceis, nervis lateralibus utrinque 8-9 obliquis subtus cum venis prominulis, petiolo latiusculo canaliculato, cymis multifloris bracteatis, pedunculo robusto, pedicillis gracilibus, bracteis ovatis obtusis parvis scarioso-marginatis, calycis lobis ovatis exterioribus minoribus, corollae tubo extus glabro lobis ciliolatis.

HAB.—Fernando Po, *G. Mann*, 1164; Rio del Rey, *Johnston*, 44.

Frutex ad 40 ped. altus, scandens. *Folia* 5–6 poll. longa, 2½–3 poll. lata, *petiolus* 4–6 lin. longus. *Pedunculus* 3–5 lin. longus, *pedicelli* ad 6 lin. longi. *Calyx* 1½–2 lin. longus. *Corollae* tubus circa 5 lin. longus, lobi 6 lin. longi latique.

The stamens are exactly those of *Echitideae*, amongst which *Holalafia* approaches nearest to *Alafia*. The ovary is, however, perfectly entire, with a thin septum. The inflorescence is also that of *Alafia* but the flowers are by far larger than in any species of that genus.

119. **Oncinotis gracilis,** *Stapf;* scandens, ramis patule rufo-hirsutis, foliis obovato-oblongis acuminatis basi rotundatis vel subacutis supra saturate subtus laete viridibus, supra in nervis nec non in parenchymate sparsissime hirsutis subglabrescentibus subtus imprimis in costa densius hirsutis membranaceis nervis utrinque 5–6 obliquis subtus prominulis, cymis 10–2-floris contractis in racemis vel paniculis axillaribus et terminalibus breviter pedunculatis rufo-hirtellis gracilibus pedicellis brevibus vel brevissimis, bracteis minutis deciduis, calyce 5-partito lobis anguste ovatis subpatulis minute puberulo eglanduloso, corolla in alabastro subsubulata viridula aperta tubo basi vix ampliato extus minutissime puberulo intus dense piloso, fauce constricta squamis 5 ligulatis exsertis alternis instructa, lobis oblongo-lanceolatis tubo 1½-plo longioribus patulis vel reflexis, staminibus supra basin insertis filamentis brevissimis tubo adnatis albo-pilosis antheris lanceolatis acutis ebarbatis lobis basalibus incurvis, disco 5-lobo, carpellis liberis puberulis, stylo brevissimo, stigmate oblongo incrassato apiculo bilobo.

Hab.—Lagos, *H. Millen*, 106.

Folia 3–3½ poll. longa, 1½ poll. lata, *petiolus* ½ poll. longus. *Racemi* vel *paniculae* ad 3 poll. longae, *pedunculus* ½–¾ poll. longus, *pedicelli* ad 1 lin. longi. *Calyx* ½–¾ lin. longus. *Corollae* tubus 1¼ lin. longus, lobi vix 2 lin. longi.

120. **Baissea tenuiloba,** *Stapf;* frutex interdum scandens, ramis gracilibus glabris vel novellis minutissime furfuraceis, foliis oblongis longiuscule acuminatis basi acutis raro rotundatis firme sed tenuiter membranaceis opacis subtus in axillis nervorum rufo-pilosis caeterum glaberrimis, nervis lateralibus utrinque 6–7 nervis subhorizontalibus tenuissimis valde approximatis, cymis in racemis axillaribus et terminalibus gracilibus minutissime furfuraceis, bracteis minutis breviter lanceolatis, calyce quinque-lobo minutisssime obscure furfuraceo lobis ovatis obtusis, corolla intense purpurea vel violacea tubo e basi contracta campanulato interdum semigloboso lobis e basi ovata longe et angustissime caudato-acuminatis tubo plus quam duplo longioribus, staminibus medio tubo insertis antheris dorso superne barbulatis, stylo brevissimo, stigmate oblongo crasso apice lobulato tenuiter apiculato.

Hab.—Bonny River, *G. Mann*, 504; *Kalbreyer*, 73; Cameroon River, *G. Mann*, 2187.

Frutex 12–15 ped. altus. *Folia* ad 4½ poll. longa, ad 1¾ poll. lata, *petiolus* ad 6 lin. longus. *Inflorescentia* 1–3 poll. longa, *pedicelli* ad lin. longi. *Calyx* ¾ lin. longus. *Corollae* tubus 1½ lin. longus lobi 4–5½ lin. longi.

Very like *B. leonensis, Benth.*, in habit, but distinguished by the less numerous nerves of the leaves, the very narrow more or less filiform corolla lobes, and the colour of the corolla.

121. **Baissea laxiflora,** *Stapf;* frutex scandens ramis minutissime furfuraceo-tomentellis fuscis gracilibus, foliis obverse lanceolatis rarius

oblongis acuminatis acumine plerumque brevi acuto basi acutis vel cuneatis membranaceis subtus in axillis nervorum pilosis caeterum glaberrimis, nervis lateralibus utrinque 5-6 valde obliquis subtus prominulis venis transversalibus tenuissimis valde approximatis, cymis 3–1-floris in racemis gracillimis laxissimis axillaribus et terminalibus minutissime furfuraceis, bracteis minutis ovatis, pedicellis gracilibus plerumque corollae tubo aequilongis, calyce 5-partito minutissime furfuraceo, lobis ovatis apice patulis, corollae tubo tubuloso-campanulato, lobis e basi cordato-ovata lanceolatis tubo paulo longioribus, staminibus generis, disco angusto 5-crenulato, stylo tenui brevi, stigmate breviter oblongo crasso apice lobulato tenuiter apiculato.

HAB.—Muni River, *G. Mann*, 1756.

Folia ad 3 poll. longa, 1 poll. lata, *petiolus* 1–2 lin. longus. *Inflorescentia* ad 4 poll. longa, *pedicelli* ad 2½ lin. longi. *Calyx* ¾ lin. longus. *Corollae* tubus 2-2½ lin. longus, lobi 2½–3 lin. longi.

122. **Baissea brachyantha,** *Stapf;* scandens, ramis novellis minute rufo-furfuraceis mox glabratis, foliis lanceolatis usque obovato-ellipticis, obtusiuscule acuminatis basi acutis membranaceis subtus in axillis nervorum rufo-pilosis caeterum glaberrimis, nervis lateralibus utrinque 8–10 obliquis subrectis parallelis tenuibus subtus prominulis venis transversalibus subhorizontalibus densissimis tenuissimis petiolo gracili longiore cymis in paniculis axillaribus terminalibusque gracilibus brachiatis vel in apice pedunculi congestis subumbellatis, minute furfuraceis, pedunculis saepe 2–3 ex axillis foliorum, pedicellis gracilibus, bracteis ovatis acutis minutis, calyce globoso-ovoideo 5-partito lobis ovatis obtusis intus basi cum glandulis minutis alternantibus, corollae tubo ex ima basi constricta infundibiliformi fauce ampla lobis ovato-lanceolatis tubo aequilongis vel vix longioribus, staminibus infra medium insertis, disco leviter 5-crenulato angusto, stylo obconico brevi stigmate ovoideo basi annulato tenuiter apiculato.

HAB.—Bagroo River, *G. Mann*, 854.

Folia 2–3 poll. longa, 10 lin.—2 poll. lata, *petiolus* ad 6 lin. longus. *Inflorescentia* ad 2 poll. longa, *pedunculus* ad 1½ poll. longus, *pedicelli* ad 2 lin. longi. *Calyx* vix ¾ lin. longus. *Corollae* tubus 1¼ lin. longus, ad faucem 1¼ lin. latus, lobi 1½–1¼ lin. longi.

123. **Baissea dichotoma,** *Stapf;* scandens, ramis novellis minutissime fusco-furfuraceis glabrescentibus, foliis oblongo-ellipticis sensim in acumen saepe longum obtusiusculum vel acutum abeuntibus basi acutis membranaceis novellis supra in costa minute furfuraceis citissime utrinque glaberrimis, nervis lateralibus utrinque 6–8 obliquis sub margine valde arcuatis, venis transversalibus subhorizontalibus valde indistinctis, petiolo longo tenui, cymis in paniculis dichotome multiramosis gracilibus ramis ramulisque divergentibus fusco-furfuraceis, pedunculis brevibus, pedicellis gracilibus, bracteis minutis ovatis vel lanceolatis acutis, calyce semigloboso 5-subpartito minutissime furfuraceo, lobis rotundatis obtusis basi intus cum glandulis minutis alternantibus, corollae tubo e basi ima constricta urceolato-campanulato extus tenuissime furfuraceis, lobis e basi cordato-ovata lanceolatis tubo vix aequilongis, staminibus infra medium insertis antheris dorso barbulatis, disco 5-crenato, stylo brevi obconico, stigmate subcylindrico apice lobulato tenuiter apiculato.

HAB.—Gaboon, Munda, Sibange farm, *H. Soyaux*, Pl. Occ. Afr., 393.

Folia ad 4 poll. longa, ad 1½ poll. lata, *petiolus* 8–11 lin. longus. *Inflorescentia* ad 2½ poll. longa, *pedunculus* ½ poll. longus, *pedicelli* ad 1½ lin. longi. *Calyx* ½ lin longus. *Corollae* tubus 1–1¼ lin. longus, medio 1¼ lin. latus, lobi 1–1¼ lin. longi.

124. **Baissea angolensis,** *Stapf;* ramis novellis rufo-furfuraceo-tomentellis glabrescentibus, foliis oblongis rarius subobovato-oblongis acute vel obtusiuscule acuminatis basi rotundatis, rarius subcordatis firme membranaceis interdum glaberrimis axillis nervorum subtus plerumque rufo-pilosis exceptis, nervis lateralibus utrinque 4-6 obliquis subtus prominentibus venis transversalibus subhorizontalibus vel marginem versus leviter deflexis, tenuibus in foliis inferioribus utrinque prominulis, petiolo brevi, cymis paucifloris pedunculatis in racemis vel paniculis brachiatis gracilibus axillaribus et terminalibus breviter pedunculatis furfuraceo-hirtellis pedicellis gracilibus, bracteis in rhachi primaria elongatis ovatis vel lanceolatis sub cymis minutis vel interdum foliaceis, calyce 5-partito pro genere majusculo lobis ovato-lanceolatis furfuraceo-hirtellis, corollae tubo tubuloso-campanulato lobis e basi cordato-ovata lanceolatis acutis vel acuminatis tubo 1½-plo longioribus, staminibus infra medium insertis antheris dorso glabris vel pilis perpaucis instructis, disco tenui indistincto, stylo obconico minutissime hirtello sensim in stigma crassum apice lobulatum conico apiculatum abeunte.

Hab.—Angola, *Welwitsch*, 5,967.

Folia ad 3 poll. longa, ad 1½ poll. lin. lata, *petiolus* ad 1½ lin. longus. *Inflorescentia* ad 5 poll.' longa, *pedicelli* ad 2 lin longi. *Calyx* ad 1 lin. longus. *Corollae* tubus 2–2½ lin. longus, lobi 3–4 lin. longi.

Var. **major,** *Stapf;* foliis majoribus ad 4½ poll. longis, ad 2 poll. latis, bracteis elongatis, calyce lobis lanceolatis ad 1¾ lin. latis, corollae lobis ad 4 lin. longis.

Hab.—Angola, *Welwitsch,* 5,966.

This is, perhaps, only a very robust state of the typical form.

SOLANACEÆ.

Auctore C. H. Wright.

125. **Solanum phytolaccoides,** *Wright;* suffruticosum glabrum, foliis ovatis acuminatis dilute viridibus, inflorescentiâ terminali, umbellis racemose dispositis, calyce cupulâri pubescenti, corollâ rotatâ extus pubescenti intus glabrâ segmentis 5 linearibus, staminibus 5 filamentis brevibus, antheris elongatis postice pubescentibus rimis longitudinalibus dehiscentibus, ovario globoso glabro, stylo staminibus duplo longiore.

Hab.—Abyssinia, *Schimper* 310; Kilimanjaro, *H. H. Johnston.*

Folia 3-4 poll. longa, 1½–2 poll. lata; *petiolus* 1 poll. longus. *Pedicelli* 6 lin. longi. *Calyx* 1 lin. longus. *Corolla* 6 lin. longa.

126. **Solanum Welwitschii,** *Wright* (*S. pendulum*, Welw. mss. non Ruiz et Pav.); fruticosum scandens? caule tereti levi, foliis oblongis utrinque glabris, paniculis strictis terminalibus, calyce cupulari 5–dentato, corollâ urceolatâ breviter 5-lobatâ valvatâ extus pubescenti, staminibus 5 filamentis brevissimis antherisque elongatis conniventibus, ovario globoso, stylo filiformi staminibus duplo longiore.

Hab.—Angola, *Welwitsch* 6081, 6098.

Folia 5 poll. longa, 2½ poll. lata; *petiolus* 1 poll. longus. *Pedicelli* 1–3 lin. longi. *Calyx* 1-2 lin. longus. *Corolla* 4 lin. longa.

Var. **strictum,** *Wright;* a typo differt cymis elongatis subracemosis.

Hab.—Munga, *Schweinfurth* 3498; Fernando Po, *Mann* 274.

Var. **oblongum,** *Wright;* a typo differt foliis angustioribus obtusioribus basi acutioribus.

Hab.—Ambas Bay, W. Africa, *Mann.*

127. **Solanum pauperum,** *Wright;* fruticosum ramosum, caule tereti leviter rugoso lepidoto, foliis lanceolatis petiolatis glabris crenulatis siccitate atris, inflorescentiâ subterminali umbellatâ, calyce cupulari 5-dentato leviter pubescenti, corollæ segmentis 5 oblongis extus pubescentibus, staminibus 5, antheris sessilibus, baccâ globosâ nitenti.

Hab.—Angola, *Welwitsch* 6054, 6075.

Folia 15 lin. longa, 7 lin. lata; *petiolus* 10 lin. longus. *Pedicelli* 6 lin. longi. *Calyx* 1 lin. longus. *Corolla* 4 lin. longa. *Bacca* 5 lin. diam.

128. **Solanum inconstans,** *Wright;* fruticosum scandens, caule tenui tereti levi, foliis geminatis oblongis acutis supra leviter pilosis subtus glabris, cymis racemose dispositis, calyce breviter cupulari 5-dentato, corollâ calyce 4-plo longiore urceolatâ violaceâ segmentis 5 obtusis, staminibus 5 antheris subsessilibus ante anthesin conniventibus, ovario oblongo, stylo filiformi antheris æquilongo.

Hab.—Fernando Po, *Mann* 62; Cameroons, *Kalbreyer* 172.

Caulis 10 ped. altus. *Folia* 3–4 poll. longa, 2 poll. lata; *petiolus* 1–1¼ poll. longus.

129. **Solanum campanuliflorum,** *Wright;* suffruticosum, caule tereti pilis simplicibus vestito, foliis integris ovato-acuminatis petiolatis utrinque pilis simplicibus sparse vestitis, floribus paucis, calyce campanulato dentibus 5 obtusis, corollâ calyce 4-plo longiore 5-lobatâ extus pilosâ, staminibus 5, antheris brevibus filamentis paulo longioribus, ovario globoso, stylo brevi pubescenti.

Hab.—Angola: Cunene, *H. H. Johnston.*

Folia 2 poll. longa, 1 poll. lata; *petiolus* 1 poll. longus. *Calyx* 1 lin. longus. *Corolla* 4 lin. longa.

130. **Solanum Monteiroi,** *Wright;* fruticosum pilis stellatis vestitum, caule inermi, foliis oblongis sinuatis basi inæqualibus petiolatis, inflorescentiâ racemosâ oppositifoliâ, calyce campanulato extus stellatim tomentoso, segmentis 5 subulatis corollâ campanulatâ purpureâ lobis triangularibus, antheris filamentis 3-plo longioribus, baccâ magnâ purpureâ.

Hab.—Angola, Bonia, *Monteiro.*

Folia 6 poll. longa, 4 poll. lata; *petiolus* 2 poll. longus. *Calyx* 6 lin. longus. *Corolla* 1 poll. diam.

"Cultivated all over Angola. Large purple fruit used as a vegetable." —*Monteiro.*

131. **Solanum albifolium,** *Wright:* suffruticosum, caule tereti juvenili stellatim albo-tomentoso, foliis pinnatifidis petiolatis supra atro-viridibus subtus dense stellatim albo-tomentosis, cymis oppositifoliis, calyce brevi cupulari 5-dentato, corollâ rotatâ extus et intus secus

costam stellatim tomentosâ segmentis 5 linearibus, antheris 5 subsessilibus, ovario globoso pubescenti, stylo brevi subulato, baccâ globosâ glabrâ.

HAB.—Angola, *Welwitsch* 6095, 6095*b*.

Folia 5 poll. longa, 3 poll. lata. *Calyx* 4 lin. longus. *Corolla* 5 lin. longa.

132. **Solanum albotomentosum**, *Wright;* suffruticosum, caule tereti pilis stellatis dense vestito, foliis lanceolatis plus minusve undulatis petiolatis, inflorescentiâ racemosâ pauciflorâ, pedicellis post anthesin reflexis, calyce campanulato extus stellatim tomentoso segmentis 5 tubo æquilongis, corollâ rotatâ calyce 3-plo longiore extus stellatim tomentosâ staminibus 5 filamentis brevissimis antherisque subulatis, ovario globoso apice stellatim tomentoso, stylo staminibus æquilongo, baccâ globosâ glabrâ aurantiacâ.

HAB.—Angola, *Welwitsch*, 6048, 6077.

Folia 3 poll. longa, 1¼ poll. lata; *petiolus* 6 lin. longus. *Corolla* 5 lin. longa. *Bacca* 6 lin. diam.

133. **Solanum vagans**, *Wright;* fruticosum, caule tereti pilis stellatis brunneis et spinis brevibus recurvatis vestito, foliis solitariis oblongo-lanceolatis acutis basi apiceque utrinque pilis stellatis brunneis vestitis, calyce cupulari 4-dentato striato, corollâ rotatâ extus pilis stellatis brunneis vestitâ segmentis 4 ligulatis, staminibus 4, antheris breviter pedicellatis poris 2 terminalibus dehiscentibus, ovario globoso, stylo staminibus paulo breviore.

HAB.—Dar Salam Coast. Zanzibar, *Sir John Kirk.*

Folia 3 poll. longa, 1 poll. lata; *petiolus* 6 lin. longus. *Corollæ* segmenta 6 lin. longa. *Stamina* 5 lin. longa.

134. **Solanum Rohrii**, *Wright;* fruticosum, caule tereti stellatim tomentoso spinis rectis compressis armato, foliis lanceolatis leviter sinuatis utrinque pilis inæqualiter stellatis vestitis, inflorescentiâ cymosâ, calyce armato profunde 4-lobato, corollâ albâ extus stellatim tomentosâ, segmentis 4 linearibus, staminibus 4, antheris subulatis sessilibus corollæ lobis paulo brevioribus, ovario globoso, stylo tereti stellatim tomentoso, baccâ globosâ glabrâ coccinea.

HAB.—Abyssinia, Ankober, *Rohr* 445; Muata Manja, *Sir John Kirk.*

Folia 4 poll. longa, 2 poll. lata. *Calycis* lobi 2 lin. longi. *Corollæ* lobi 3 lin. longi. *Bacca* 6 lin. diam.

135. **Solanum melastomoides**, *Wright;* suffruticosum, caule tenui tereti juvenili stellatim albo-tomentoso spinis rectis leviter compressis armato, foliis oblongis integris vel leviter lobatis breviter petiolatis utrinque stellatim tomentosis subinermibus, floribus paucis magnis, calyce cupulari dentibus 5 obtusis, corollâ late campanulatâ plicatâ glabrâ partibus exterioribus æstivatione exceptis, staminibus 5, filamento postico reliquis multo longiore, antheris elongatis obtusis, stylo staminibus paulo longiore.

HAB.—Somali-land: Bwobi, Harradigit, *James* and *Thrupp.*

Folia 2 poll. longa, 1 poll. lata; *petiolus* 3 lin. longus. *Calyx* 2 lin. longus. *Corolla* 1 poll. diam. *Antheræ* 3 lin. longæ.

136. **Solanum trepidans**, *Wright;* suffruticosum, caule tereti stellatim tomentoso spinis brevibus compressis armato, foliis lanceolatis sinuatis

basi acutis petiolatis utrinque stellatim tomentosis, costâ armatâ, inflorescentiâ cymosâ, calyce campanulato stellatim tomentoso dentibus 5 brevibus triangularibus, corollâ calyce 4–6-plo longiore late campanulatâ dilute lilacinâ segmentis acutis late triangularibus, staminibus 5, filamentis brevissimis, ovario subgloboso apice stellatim tomentoso.

HAB.—Zambesi: Shupanga, *Stewart;* near Bishop Mackenzie's house, Shiré Valley, *Scott.*

Caulis 1–3 ped altus. *Folia* 4 poll. longa, 1 poll. lata; *petiolus* 1 poll. longus. *Calyx* 2 lin. longus. *Corolla* 10 lin. longa. *Antheræ* 3 lin. longæ.

137. **Solanum Mannii**, *Wright;* suffruticosum ramosum, caule tereti spinis compressis armato juvenili stellatim albo-tomentoso, foliis inæqualiter geminatis petiolatis ovatis plus minusve pinnatim lobatis basi inæqualibus utrinque stellatim tomentosis, cymis ramosissimis, pedicellis pilis glandulosis vestitis, calyce cupulari segmentis 5 lanceolatis glandulosis, corollâ campanulato-rotatâ albâ 5-fidâ extus mediis segmentorum stellatim tomentosâ, staminibus 5 filamentis brevibus, antheris tenuibus subulatis, ovario globoso glabro, stylo curvato staminibus multo longiore, baccâ globosâ.

HAB.—W. Africa: Gaboon, Munda, *Soyaux* 329, Fernando Po, *Mann* 55.

Caulis 10 ped. altus. *Folia* 6 poll. longa. 4 poll. lata; *petiolus* 1 poll. longus. *Corolla* 9 lin. diam. *Antheræ* 3 lin. longæ.

Var. **compactum**, *Wright;* a typo differt foliis minus tomentosis, cymis congestis.

HAB.—Angola, *Welwitsch* 6105, 6052, 6080, *Monteiro.*

138. **Solanum Thruppii**, *Wright;* suffruticosum, caule erecto tereti sparse stellato-tomentoso spinis rectis compressis armato, foliis ovatis 7–9-lobatis petiolatis basi acutis inæqualibus utrinque pilis stellatis vestitis et venis primariis spinosis, inflorescentiâ corymbosâ, calyce urceolato extus stellatim tomentoso et spinis parvis pluribus armato dentibus 5 acutis, corollâ rotatâ purpureâ intus glabrâ extus dense stellatim tomentosâ segmentis 5 acutis, antheris 5 subsessilibus, ovario ovato apice hirsuto, stylo staminibus paulo longiore.

HAB.—Somali-land: Adela Galla, Bwobi, Hahi, *James* and *Thrupp.*

Folia 5 poll. longa, 4 poll. lata; *petiolus* 2–3 poll. longus. *Calyx* 6 lin. diam. *Corolla* 15 lin. diam. *Antheræ* 3 lin. longæ.

139. **Solanum chrysotrichum**, *Wright;* fruticosum pilis aureis stellatis omnino vestitum, spinis paucis brevibus tomento fere celatis, foliis ovatis acutis pinnatim 7–9-lobatis spinis paucis secus costam armatis, inflorescentiâ cymosâ, calyce campanulato lobis 5 patentibus tubo spinosissimo, corollâ late campanulatâ purpureâ intus glabrâ lobis 5 ovatis, staminibus 5 filamentis brevibus antherisque obtusis corollæ lobis multo brevioribus, ovario globoso, stylo filiformi staminibus multo breviore.

HAB.—Nyassa-land, *Buchanan* 494 bis, 776.

Folia 5 poll. longa, 3–4 poll. lata; *petiolus* 1 poll. longus *Calyx* 6 lin. longus. *Corolla* 1 poll. vel ultra diam. *Antheræ* 3 lin. longæ.

CCCLXXV.—THE COFFEE-LEAF MINER.

(*Cemiostoma coffeellum*, Stainton.)

An enemy to coffee trees in Brazil and some parts of the West Indies is found in the caterpillar of a small moth which mines in the substance of the leaves, and causes rusty-coloured blotches on their upper surface. This disease is quite familiar to coffee planters, and the object of the present note is not to enlarge on its destructiveness, but to bring together what has already been written on the subject for the convenience of reference in official correspondence. The insect in Brazil was carefully studied by Mr. B. Pickman Mann, who was engaged as Entomologist to the Government of Brazil. His observations, with plates, are given in the "American Naturalist," Vol. VI., pp. 332 and 596. Mr. Mann there calls it the "White Coffee-Leaf Miner," and in 1872 he considered it "the greatest enemy of coffee culture in Brazil."

The injury to the coffee leaves is caused, as already stated, by the caterpillar or larva. This lives within the soft tissues of the leaves, immediately beneath the thin cuticle or epidermis. It consumes these tissues, known as parenchyma, and thus deprives the plant of the means of elaborating its food. The presence of the miner is soon shown by rusty-coloured blotches, often turning almost black in the centre. After the caterpillar has stopped feeding, it changes into a chrysalis, and this, after it has emerged from its burrow, and covered with its silken web, may easily be found in a fold of the leaf. The mature insect is a moth, beautifully ornamented with silvery wings, these would hardly cover the breadth of the little finger nail. The male and female moths fly actively, with a jerking flight, and at other times they may be seen at rest upon the leaves and branches, but are easily disturbed. They belong to the tribe of the cloth-worm moths (*Tineina*), which are all of small size, whose wings are fringed with hairs. An account, probably the first published, of the injury done to coffee in the West Indies is given by Guérin-Méneville et Perrottet, in a memoir addressed to the French Ministry of Marine (Paris, 1842). It is there described as a species of *Elachista*.

The following note appeared in the *Kew Report*, 1876, pp. 20–21.

"*Cemiostoma coffeellum*.—A disease has for many years been known to exist in the island of Dominica, and also to a large extent in Brazil. This was characterised by the appearance of large discoloured blotches upon the leaves, leading eventually to their decay and fall, and so seriously imparing the health of the trees. Various theories, mostly of a purely *à priori* character, were started to explain the cause, but competent investigation has placed the true explanation beyond the shadow of a doubt. The leaves are destroyed by the larvæ of a minute but very prolific moth. They live between the two surfaces of the leaves, and gradually consume the intermediate cellular tissues. The moth is, in fact, a member of the same genus as that which mines the leaves of the laburnum in our gardens. This insect is said to lessen the coffee crop in Brazil by at least one-fifth. The little pest has been found in the Antilles, island of Martinique, province of Rio Janeiro, and over the whole coffee region of Brazil. According to an inclosure in

Mr. Acting-Consul Austin's despatch to the Foreign Office, it is of comparatively recent introduction into Brazil:—

"'In 1854, or soon after, the Imperial Government, desirous of introducing several species of coffee amongst us advantageously cultivated in other parts of the world, committed the error of importing plants instead of seeds, and thus we had here coffee trees grown in Ceylon, Martinique, Bourbon, &c., it being quite possible that in this manner the germ of the coffee disease was imported.' This is also the opinion of Mr. B. Pickman Mann, who has reported in the most admirable manner upon the whole subject to the Brazilian Government (*see* "American Naturalist," 1872, June and October). I may also call attention to a similar transference, from the Old to the New World, of the moth which injures the sugar cane, and which is referred to below. Those interested in the matter should procure and study Mr. Mann's report. The only plan of radically dealing with this pest is to destroy the injured leaves while the coffee-fly is still in the larval state. Mr. Mann remarks: 'If the leaves were picked at such a time as to take the greatest number of larvæ when they were about two weeks old, it would not be difficult to select them, as the size of the blotches would make them very noticeable. I find that the expense would be more than met by the next year's crop.'"

"Mr. Consul Pauli has sent from Puerto Rico leaves which are affected with the *Cemiostoma* in its most characteristic manner. The disease appears to do little injury in this island, and no particular attention is paid to it."

"In Venezuela a disease occurs which is known by the name of 'Candelillo,' and which is also, according to information supplied by Mr. R. T. C. Middleton, Her Majesty's Minister at Caracas, identical with the "mancha de hierro," or "iron stain." Dr. Ernst, however, believes them to be different, and attributes the latter to the *Cemiostoma.* The specimens forwarded to this country by Mr. Middleton of the iron stain are, however, at once distinguishable from the ravages of the *Cemiostoma.* The leaves have been submitted to the Rev. M. J. Berkeley, who reports that they are affected by a minute fungus, a *Depazea*, for which he proposes the specific name of *maculosa.* It has fusiform spores ·0008 in. long, and containing about seven nuclei. In Venezuela coffee appears to suffer little, comparatively speaking, from maladies of any kind."

A further note appeared in the *Kew Report* for the year 1877, pp. 28–29:—

"*Cemiostoma coffeellum.*—In my report for last year, I mentioned (p. 21) the existence in Venezuela of a disease known by the name of "Candelillo," and which Mr. R. T. C. Middleton, Her Majesty's Minister at Caracas, stated to be identical with the "mancha de hierro" or "iron stain." Prof. Ernst, however, considered that they were different, and that the "iron stain" was the work of *Cemiostoma coffeellum.* The specimens of "iron stain" forwarded to this country by Mr. Middleton proved to be the work of a fungus (*Depazea maculosa*) and not of an insect. But Prof. Ernst has since kindly sent to me undoubted examples of the ravages of the *Cemiostoma*, and the presence of that destructive insect in Venezuela can no longer be doubted. It has now therefore been ascertained to be more or less distributed through the Leeward and Windward Islands (Puerto Rico, Dominica, and Martinique) and all the Atlantic coffee-growing districts of South America."

"The ravages of the *Cemiostoma* over the greater part of this immense area date only within the last 25 years. In Dominica, Dr. Imray informed me that he was not without hopes that by care and attention the mischief caused by it might be gradually overcome, but the following extract from a more recent communication will show how extremely difficult it is to make any progress against it, and how important it will prove if the apparent immunity of the Liberian coffee from its attacks should continue to be verified."

"Dr. Imray writes: 'My Arabian coffee trees suffered frightfully last season from the *Cemiostoma*, the small crop that was coming on upon many of the trees was all but destroyed. They begin to throw out leaves again, but I almost despair of finding any means of destroying the insect, where the circumstances and conditions are favourable for its propagation and existence. The problem is to discover the converse of this proposition, and I think I have made one step in that direction; it is, that the coffee trees should be cultivated almost, if not altogether, in the shade of trees, with no underwood or bush, as we say here. The coffee trees should scarcely see the sun. In a locality that is continuously cool and moist and perfectly shaded by the foliage of large trees they thrive best, and show very little appearance of the blight. The inference is that those conditions are adverse to the existence of the insect. From such inquiries as I have made, the coffee produced in this country, and it is not inconsiderable in quantity, is furnished by trees growing as above described. I intend to continue the experiment by planting some land cleared of low brushwood, and leaving the large trees standing. From the experience of fully two years now I do not think that in this island [just now] the *Coffea arabica* can be successfully grown in the open, but we have the Liberian to fall back upon.'"

"With respect to the immunity of the Liberian coffee from the attacks of the *Cemiostoma* Dr. Imray writes: 'That the Liberian coffee is impervious to the attacks of the 'white fly,' I consider a settled point. My Liberian trees have been now growing for over two years, nearly three, among the country coffee trees covered with the blight, and thus continuously exposed to the attacks of the insect, but not a leaf has been touched, indeed the destruction of one leaf by the fly would of course amount to the destruction of, or at least an attack upon all, but clearly this species of coffee is safe from the attacks of the *Cemiostoma coffeellum*. Such being the case I have abandoned all further experiments on *arabica*, as being simply a waste of time and money.'"

In the West Indies the *Cemiostoma* has been noticed to attack very severely Arabian coffee growing at low elevations, and especially trees in the open, without shade. On the other hand, coffee grown at elevations above 3,000 feet is apparently untouched. This observation, which, perhaps, more particularly applies to Jamaica, is of considerable value in estimating the distribution of the injury done to coffee culture by this insect. The natural home of the Arabian coffee in warm regions is on mountain slopes. It is, therefore, out of its element in tropical America at sea-level, and its enfeebled condition, brought about by unfavourable surroundings, renders it less able to resist the attacks of such a plentiful and persistent enemy as the *Cemiostoma*. The early plantations in the Antilles, for convenience of management, were started at low elevations, well within the range of the insect. As they gradually extended higher and higher into the mountains the trees increased in vigour, the leaves were more luxuriant and firmer in texture, and the insects were either unable to attack them or they could not live in the comparatively cooler climate. In any case, the best cure for the *Cemiostoma* would appear to be the restriction of the cultivation of the Arabian coffee, at least, to the higher elevations. Should the insects attack coffee on low-lying fields the first remedy should be to provide suitable shade; and, after that, to gather the leaves as soon as they are attacked, and destroy them by burning. The observations made by Dr. Imray, in 1877, with regard to the immunity of Liberian coffee from attacks of the insect, have been fully borne out. This coffee, growing even close to the sea, and in the neighbourhood of Arabian coffee infested with *Cemiostoma* is left untouched.

It may be added that this disease is sometimes mentioned in correspondence and reports in the West Indies as the "coffee-leaf blight." The destructive coffee-leaf disease of Ceylon, caused by a minute fungus, *Hemileia vastatrix*, is, however, so far, not known in the coffee areas of the New World. It would be well to distinguish clearly between the *Cemiostoma* and *Hemileia*, for the ravages of the former, though severe at certain periods, are not absolutely destructive to coffee. On the other hand, the introduction of the *Hemileia* to the New World would result in a by no means gradual extinction of the whole industry. Coffee production would then to a large extent depend upon the yield of Liberian coffee trees, and this is another important consideration in favour of the more general planting of this species in all localities where it is likely to thrive. Full information respecting the cultivation and curing of Liberian coffee has appeared in the *Kew Bulletin*, as follows:—Historical and Descriptive Account, 1890, pp. 245–253; Liberian Coffee at the Straits Settlements, with value of parchment coffee cleaned and sold in London, 1888, pp. 261–263; Yield of Liberian Coffee Estates in Selangor and Ujong, 1890, pp. 107–108, and 1892, pp. 277–282; Miscellaneous Note, 1893, p. 25; Husking in London not advisable, *ibid*, 132; Liberian Coffee at Sierra Leone, *ibid*, p. 167; Pulping Liberian Coffee, *ibid*, pp. 204–206.

CCCLXXVI.—MISCELLANEOUS NOTES.

MR. J. F. JEFFREY, Attendant in the Herbarium of the Royal Gardens, has been appointed Attendant in the Herbarium of the Royal Botanic Gardens, Edinburgh.

The Lords of the Treasury, on the recommendation of the First Commissioner of Her Majesty's Works and Public Buildings, have been pleased to raise the MINIMUM WAGE FOR LABOURERS in the Royal Gardens to 19*s*. per week. It may be noted that before 1847 the minimum appears to have been only 12*s*.; in that year it was raised to 14*s*.; in 1865 to 15*s*.; in 1873 to 17*s*.; in 1889 to 18*s*. The total rise of the minimum wage in the preceding half century has been about 37 per cent.

Hooker's Icones Plantarum.—By an oversight the fourth part of the third volume of the fourth series was issued without the index. It will be issued with the next part published, which will probably appear before this. The opportunity may be utilised to repeat that intending purchasers can procure the whole of the third series, containing 1,000 plates, from Messrs. Dulau & Co., 37, Soho Square, W., at the reduced price of *5l.*, and current volumes at the rate of 16*s.* each.

Revision of Ordnance Map.—A fresh survey of the Royal Gardens having been made by the Ordnance Surveys, the opportunity has been taken to obtain, through the courtesy of the Director-General of the Ordnance Surveys, an authoritative statement on several points which had been long in doubt. Two of these may be placed on record. The area in which cultivation is carried on under glass is 2·604 acres, and the linear extent of footpaths is about 14 miles 48 chains.

Identification of Old Sites.—The opportunity was also taken to ascertain the sites of various buildings of historic interest, especially those connected with Richmond Gardens, which formed the western half of the present establishment, and was, till 1802, when Love Lane, which separated the two properties, was shut up, distinct from the eastern half, or Kew Gardens proper.

Love Lane itself started from the western side of the present Kew Palace, crossed the middle of the Palace Meadow, skirted the western boundary of the present Botanic Garden, passed the Lucombe Oak on the east, and then following the grass avenue through the Heath collection, took a course parallel with the Holly Walk and skirting the western steps of the Temperate House, to the Deer Park.

In the *Kew Bulletin* for 1891, p. 285, reference is made to two buildings of some celebrity in their day, the Hermitage and Merlin's Cave. The latter was conjecturally identified with the "Keeper's House" of Rocque's map. This was erroneous. The Hermitage stood on the south-west side of the present Azalea Garden. The site of Merlin's Cave corresponds with the small island in the lake nearest but one to the river; it had a duck-pond in front of it, which, therefore, on a small scale, anticipated the present lake. The Summer House on the Terrace was contiguous to the present Isleworth Ferry Gate. Ormond Lodge, occupied by George II., stood in the Deer Park 200 yards south-west of the Queen's Cottage, and the New Palace commenced by George III., but never finished, stood about the same distance due south of Ormond Lodge.

Lake in Arboretum.—This fine piece of water which is filled from the Thames is the source of the water supply of the whole establishment. It had gradually become filled more or less with mud, in some places not less than five feet deep. The task of removing this has occupied the past three winters. A gang of reserve soldiers, supplied by the "National Association for the Employment of Reserve Soldiers, &c.," has been employed for the purpose, the cost being defrayed by a special vote in the estimates. The total cost has been about 300*l.* The mud which had been all deposited from Thames water proved to have considerable manurial value, and is being employed as a top dressing for the poor soil of the Arboretum.

Leguminosæ Collection.—The collection of hardy ligneous Leguminosæ near the Pagoda has, during the past winter, been entirely rearranged.

The long canal beds have been replaced by smaller beds in which the plants have been grouped, some beds being filled by a single species. The original soil, chiefly sand, has been removed to a depth of two feet, and good loam substituted. The collection is a large one, and we have every reason to believe that it will shortly prove of considerable interest to botanists and horticulturists, and a great attraction to visitors generally.

Weldenia candida.—*Weldenia* is a monotypic genus of *Commelynaceæ*, and is a near ally of *Zebrina* and *Rhoea*, both known in gardens as Tradescantias. A figure of *Weldenia* was published in *Hooker's Icones Plantarum* about fifteen years ago under the name of *Lampra volcanica*, with the following note by Mr. Bentham: "Of this curious plant only a single specimen is known, gathered by Hartweg in the crater of the Volcan de Agua, near Guatemala, in August 1840. My friend, Mr. Salvin, on his last journey to that country, kindly undertook to search for it, but his ascent of the mountain was not at the same time of year, and he could find no trace of it. It is said to be very ornamental, and its introduction to our plant houses would be very desirable." Last year, Mr. Audley C. Gosling, Her Majesty's Minister to Central America, informed us that his sons had "made the ascent of the Volcan de Agua, and at the bottom of the crater found bulbs of the plant, which Mr. J. Donnell Smith informs me is *Weldenia candida* . . . I have planted these bulbs here, and they flower to perfection at 9,000 feet lower altitude than where found. The daily range of the thermometer in this city (Guatemala) is from 9° to 22° Centigrade (48° to 71° Fahr.), and in the Crater de Agua it is from — 6° to 11° Centigrade (21° to 51° Fahr.). If you have not this plant in cultivation I shall be happy to send you some bulbs." Mr. Gosling's offer was gladly accepted, and in September last the plants were received. They are now flowering in a cold greenhouse, and a figure has been prepared for publication in the *Botanical Magazine*. The root is a fleshy tuber from which spring six or eight strap shaped green leaves with folding bases forming a kind of stem; the flowers which are snow-white and about an inch in diameter, are borne singly on short erect scapes, each flower lasting only about a day. Singly the plants are not very effective, but no doubt in the mass they would be attractive.

Photographs of Buitenzorg.—The Royal Gardens have recently become possessed, through the liberality of Dr. Treub, Director of the Botanic Garden, Buitenzorg, Java, of a series of some thirty finely executed photographic views taken in the Gardens over which he presides. These photographs, which give a good idea of the principal features of the gardens, showing not only characteristic groups of plants, but also the several buildings, such as the museum and botanic laboratory, will be a valuable addition to the extensive and increasing set of views in colonial and foreign gardens already exhibited in Museum No. 3.

Drawings of Indian and Malayan Plants.—The collection of drawings preserved in the Herbarium has been enriched by the gift of about 200 finely executed coloured drawings of conspicuous Indian and Malayan plants. They are the work of a Mrs. Hutton (Miss Janet Robertson), the wife of an East Indian merchant, who resided at Penang from 1802 to 1808, and at Calcutta from 1817 to 1823; and the drawings were done partly at one place and partly at the other. They were presented to the Royal Gardens by Miss Mary Hutton, the daughter of the artist. Many of them are bold and vigorous representations of tropical fruits, such as the mango, durian, guava, rose-apple, papaw, and mangosteen; and of such showy genera as *Bombax, Sterculia, Pterospermum, Butea,* and *Erythrina.* The collection also contains quite a long series of species of *Convolvulaceæ.*

Drawings of Mauritius Plants.—Mr. J. W. Duncan, son of the late James Duncan, who was for many years Director of the Mauritius Botanic Garden down to 1865, has presented a collection of 85 coloured drawings of native Mauritian plants, which he made when a boy. In consequence of the great extension of cultivation, many of the rare native plants are extinct, and common ones have become rare. Many of the drawings are figures of orchids, of which we possess only very indifferent specimens, or none at all. The fact that they are localised also adds to their value. Among other rare plants represented are:—*Mussænda Stadtmanni*, *Nuxia verticillata*, and *Arndtia mauritiana.*

Dr. G. D. Haviland's Bornean Collections.—From time to time the arrival has been announced of valuable collections of plants from Kini Balu and the tropical region of North Borneo. Dr. Haviland has returned to England for a short period, bringing with him a large and long series of duplicates, which he distributed at Kew previous to his return to Borneo by way of Natal and Mauritius.

Flora of Central Tibet.—Previous to Colonel Przewalsky's explorations little was known of the flora of the vast country lying immediately north of the Himalayas, generally known as Tibet; and only portions of his discoveries have been published. Sir Joseph Hooker penetrated the fringe of this country on the Sikkim frontier; Dr. T. Thomson, Lieut.-General Strachey, and Mr. J. E. Winterbottom botanized the extreme west. That was upwards of 40 years ago. Since then various other travellers have entered the country for short distances at various points; and the rich flora of the extreme east has been made known through the extensive collections sent to Europe by Father David, Mr. Pratt, Prince Henry of Orleans, and others.

Captain Bower's journey across Tibet from west to east, in latitudes between 34 and 30 degrees, and Mr. Woodville Rockhill's journeys from north to south, in about the longitude of Lhassa, are so well known that it is only necessary to mention them in connexion with the plants collected. Surgeon-Captain W. G. Thorold accompanied Captain Bower, and made a collection of all the plants found growing at elevations between 15,000 and 19,000 feet. Mr. Rockhill also collected, and his plants, as well as Mr. Thorold's, were presented to Kew, as announced in the *Kew Bulletin* (1893, p. 369).

These collections, together with a smaller one made by Captain H. P. Picot, of the Indian Staff Corps, in the Kuen-lun plains, form the subject of a paper read by Mr. W. Botting Hemsley, before the Linnean Society, and published in the Society's *Journal* (vol. xxx., pp. 101–140.) The number of novelties is not great; but about 30 per cent. of the species are peculiar to Tibet, and another 20 per cent. only extend to the Himalayas. The chief interest of the collection, however, is in the nature and general distribution of the plants forming this exceedingly meagre vegetation, the remains, probably, of a former much richer flora. Judging from the fact that many of the species are found in the most widely separated parts of the country, even those that are not known to occur outside of Tibet, there must be few very local species. A large majority of the plants scarcely lift themselves above the surface of the soil, the characteristic type being a rosette of small leaves closely appressed to the ground with a central sessile inflorescence. With regard to altitude, 57, or just half of Thorold's plants, were collected between 17,000 and 18,000 feet, five between 18,000 and 19,000, and one, *Saussurea tridactyla*, at 19,00 feet.

Books presented by the Bentham Trust.—A number of valuable works on fungi from the library of Dr. M. C. Cooke have been purchased by the Bentham Trustees and presented to the library of the Royal Gardens. Among them were the illustrated works of Lucand and Patouillard, as far as they have been published, and Letelliers' rare "*Figures des Champignons*."

Nouvelles Archives du Muséum D'Histoire Naturelle de Paris.—Kew owes to the kind offices of the late Secretary of State for Foreign Affairs, the Earl of Rosebery, and of Her Majesty's Ambassador at Paris, the Marquess of Dufferin and Ava, a set of the second and third series of this valuable publication, the gift of the French Government. Several very important illustrated botanical contributions of considerable extent have appeared in the *Nouvelles Archives*, notably Franchet's elaboration of the rich collections made by Father David in Western China. Decaisne, Vesque, and Bornet are also among the botanical contributors. Kew also possesses the earliest series of the publications of the Muséum d'Histoire Naturelle de Paris, but not the intermediate ones. That is to say, the *Annales*, vols. 1–20, 1802–1813, but not the Index vol. 21 published in 1827; the *Mémoires*, vols. 1–20, 1815–1832; the *Nouvelles Annales*, vols. 1–4, 1832–1835. Between this date and the second series of the *Nouvelles Archives* are: 1, *Archives* vols., 1–10, 1839–1861, and 2, *Nouvelles Archives*, 1–10, 1865–1874. These two series are altogether wanting at Kew.

Coffee in Montserrat.—Besides sugar, the principal staple of this small member of the colony of the Leeward Islands, has been the cultivation of the lime. A very promising commencement appears to have now been made with coffee.

EXTRACT from letter from CURATOR, Botanic Station, St. Vincent, to ROYAL GARDENS, KEW, dated 29th December, 1893.

Through the kindness of Mr. Hamilton, the agent for the Montserrat Company, and Mr. Tebbs, the manager, I got a good insight into the lime cultivation and manufacture. Mr. Hamilton informed me that he spent some 10 years in Ceylon as a coffee planter; that he has had considerable experience in coffee cultivation is very evident, for in Montserrat at the present time there are from 80 to 100 acres of coffee all planted within the last three or four years, and a large number of the trees are bearing good crops. The elevation was from 1,200 to 1,400 feet, and I observed that on the lower side of the majority of the plants on the steep sides, a terrace of stones had been built, which acted as a receptacle for the soil which would otherwise be washed into the valleys. About 200 bushels of good parchment coffee were on hand, and next year the crop is expected to be much larger.

Jamaica Walnut.—Jamaica has long been credited in a vague way with a native walnut; partly, perhaps, in consequence of Grisebach having referred (*Flora of the British West Indian Islands*, p. 177) his *Picrodendron Juglans* (Juglans baccata, *Linn.*), a simarubeous tree, to the *Juglandeæ*, and partly because Descourtilz (*Flore des Antilles*, vii., p. 5, t. 453) has a "Noyer de la Jamaique," which he refers to *Juglans fraxinifolia*, Lam. (Pterocarya fraxinifolia, *Spach*), an old world tree. C. de Candolle, (in *DC. Prodromus*, xvi. 2, p. 138), finding it was not *Juglans fraxinifolia*, described it under the name of *Juglans jamaicensis*. Consequent on this, Engler (Engler and Prantl *Die Natürlichen Pflanzenfamilien*, iii. 1, p. 24), gives the distribution of the genus *Juglans* as temperate regions of the northern hemisphere, and one in Jamaica. Sintenis (n. 4,000) collected specimens of a veritable *Juglans* in Portorico, ("*Adjuntas in fruticetis ad Saltillo*"). This is identified by Urban as the *Juglans jamaicensis*, CDC., though how he arrived at this is difficult to conceive, considering the very dissimilar looking plant crudely figured by Descourtilz. Grisebach, (*Die Geographische Verbreitung der Pflanzen Westindiens*), records *Juglans cinerea* from Cuba, and no other West Indian locality for this or any other species. This appears to have been admitted on the authority of Richard (in Ramon de la Sagra's *Flora Cubana*, iii. p. 231), because subsequently he described (*Catalogus Plantarum Cubensium*, p. 68), specimens collected by Wright, under the name of *Juglans insularis*. Curiously enough this distinct species has been overlooked by later writers.

Respecting *Juglans jamaicensis*, CDC., Grisebach has the following note in the place cited: "Nomen *J. jamaicensis*, CDC. ex sola icone Descourtilz, t. 453, formatum, quoniam suas icones ex aliis operibus mutuare solebat, non admitto, verum inter incerta relinquo."

We have no knowledge of the former or present existence of a species of *Juglans* in Jamaica, and it seems improbable that such can be the case, considering the extent to which the island has been explored. It would be interesting to know whether the Portorico tree is indigenous. There seems no reason why it should not be; and the specimen we have seen, may well be *J. insularis* in a rather advanced state, and nearly glabrous. Indeed, we have no hesitation in referring it to that species.

Destruction of Beer Casks in India.—Specimens of oak staves injured by boring beetles were received at Kew from the India Office in 1889. These were examined by Mr. W. F. H. Blandford, M.A., F.Z.S., and a report published in the *Kew Bulletin*, 1890, pp. 182-189 (with wood cuts). Later, an insect, afterwards identified as the chief agent in cask-boring, was found to attack sugar canes in the West Indies, principally in Trinidad and Barbados. Its serious depredations, at the time, occasioned some alarm amongst planters, and gave rise to much literature and correspondence. Mr. Blandford was good enough to examine into the attack on behalf of Kew, and an exhaustive report (with a plate) was published in the *Kew Bulletin*, 1892, pp. 153-178. The sugar-borer, known as the "shot-borer," was identified as *Xyleborus perforans*, Woll. Under the authority of the Secretary of State for India in Council, Mr. Blandford was afterwards engaged to prepare a fuller and more detailed report on the destruction of beer casks in India. This report, with a plate and wood cuts, has now been published on behalf of H.M. Stationery Office, by Messrs. Eyre and Spottiswoode, price sixpence. Mr. Blandford has undertaken investigations extending over a considerable period, and he has consulted the available literature of injury to casks in all parts of the world. The chief injury to beer casks in India is undoubtedly done by the non-European *Xyleborus perforans*, although it is admitted that, in rare instances, casks made of unsound wood have been found to be attacked by species of the European *Trypodendron*. Beer casks shipped to India have not been attacked by *Xyleborus perforans* in this country, nor on the voyage, but, apparently, after their arrival at their destination. This has happened owing to the unsuitable character of some of the "go-downs" in which they have been stored. The insects were at first believed to have been exported in the casks from England, and hence "the officials in India looked to this country for the remedy for a state of things which they themselves were in a position to deal with." The conclusions arrived at by Mr. Blandford are contained in the following words: "I agree with the chemists of the Inland Revenue Laboratory in believing that with proper care in the management of go-downs in India, attention to cleanliness, and strict observation of casks stored, so that clean hogsheads shall not be placed near unsound ones nor in infected stores, further precautions will hardly be necessary to prevent loss from the attacks of *Xyleborus perforans*."

"Russian Thistle" in the United States.—This is a name given to a variety of the widely-spread *Salsola Kali*. The ordinary form inhabits saline districts in nearly all parts of the world, including the sea-shore of eastern N. America, from New England southward to Georgia; but it has never spread into cultivated fields or become troublesome as a weed in any of the Eastern States. There is, however, a variety named *Tragus*, treated by Linnæus as a species, which is at home in the south-east of Europe. By some means this has been introduced into the Western States of N. America, where it flourishes so well and reproduces itself from seed with such astonishing prolificness as to threaten to become one of the very worst weeds with which the farmer has had to contend. In the *Report of the* [United States] *Secretary of Agriculture*, for 1891, p. 356, pl. 10, it is described and figured, and some account given of its history and rapid colonisation in America. It seems desirable, in the interests of agriculture in our colonies and elsewhere, to direct special attention to this weed, though, doubtless, the various Agricultural Societies will have warned their members against it before this. In Australia especially it would probably spread with equal rapidity, once it had obtained a footing. It is an annual plant and therefore not difficult to exterminate if timely measures be taken; but in America it had widely established itself before the farmers realised its troublesome character. In Dakota, Minnesota, Wisconsin and Nebraska, it has already spread over vast areas, and it will be a long and expensive task to eradicate it, unless it should exhaust itself and lose its present amazing reproductive power. There are no signs of this, as yet; and the Agricultural Department of Nebraska has issued (*Bulletin of the Experimental Station*, vi. pp. 67-77 with five plates) a very elaborate account of this noxious weed, and suggestions for suppressing it, even going so far as to propose that an Act be passed to enforce owners and holders to destroy it. Such an Act is already in force in some States against the "Canada Thistle." The following extract will give some idea of the extent of the damage it is doing:—"In South Dakota it has now become so abundant that the damage this year (1893) has been estimated at several million dollars, and so firmly is it established there that the authorities are hopeless of being able to cope with it without aid from the general Government." The plant not only chokes the crops, but its sharp, spine-like leaves are very injurious to horses and other animals, as well as to man.

Peruvian Walnut.—In Mr. P. D. G. Clark's Report to the Directors of the (English) Peruvian Corporation, Limited, on the products of the land selected by the Commissioners in the central territory of Peru, he mentions the "Black Walnut." (*Juglans nigra*), as one of the most conspicuous trees of commercial value. He reports: "This tree, the wood of which is so valuable, is most commonly met with at elevations ranging from 2,000 to 4,000 feet. Specimens were found which gave a diameter of 49 inches, with a column-like trunk of about 75 feet." This would be in about 11 degrees south latitude. We know nothing very definite concerning the existence of a walnut in South America. None of the books on phytogeography consulted mentions such a fact; and the only published description of one is under *Juglans nigra*, Linn., *β.*, ***boliviana***, C DC. (in DC. Prodr. xvi. 2, p. 137). The leaves are described as glabrous, 28 inches long, 11-jugate, with leaflets 4–6 inches long and about 2 inches broad, and the nuts as being more coarsely wrinkled than those of typical *Juglans nigra*. It was collected in the temperate regions of Bolivia by Weddell, and is preserved in the Paris Herbarium. This would be considerably south of the Peruvian locality. In the Kew Herbarium there are leaves of a *Juglans* collected by Spruce in woods on the upper Pastasa river, in about 2° south latitude. He describes it as a spreading tree, sixty feet high, bearing an edible fruit, much larger than the common walnut, but he had not seen it ripe. The inhabitants called it "*Tocte*." These leaves are very hairy on the under surface, and sparingly sprinkled with stellate hairs on the upper surface; and it is altogether very much more like large examples of the northern *J. cinerea*, Linn., than *J. nigra*, Linn. From Ocaña, New Grenada, we have a specimen in young fruit and male catkins, collected by Kalbreyer, who notes that it was there cultivated for its fruit, which had a very thick, hard shell. This is probably the same species as Spruce's; and the very slender male catkins, with few distant flowers, indicate a species distinct from *J. cinerea*. Still the differences from the latter are not so evident that one would venture to describe it as a different species without much fuller material. There is also in the Kew Herbarium a leaflet and a portion of the rachis of a leaf, sent by Dr. Ernst, in 1872, as "found at Caracas," Venezuela. The same botanist, in an account of the woods of Venezuela (*La Exposicion Nacional de Venezuela en* 1883, p. 219), describes that of the "Nogal," which he refers without doubt to *Juglans cinerea*, as dull brown, very similar to that of the walnut of Europe; easily worked, and much used in cabinet-making. Thus there is trustworthy evidence of the existence of one or more species of walnut in South America, ranging from 10 degrees north to at least 15 degrees south latitude. This is all the more remarkable because, so far as we are aware, no species has been found in Central America south of Orizaba in Mexico.

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 89.] MAY. [1894.

CCCLXXVII.—LIQUORICE.

(*Glycyrrhiza glabra*, L.)

In consequence of the large quantities of Liquorice root now exported from Asia Minor and other Liquorice-growing countries to America, where it is used in the preparation of tobacco for chewing purposes, and also in making a fancy drink, a considerable amount of attention has been given to the introduction of the plant in India, America, and other countries where it is at all likely to thrive.

The Liquorice plant (*Glycyrrhiza glabra*, L.) is a native of North Africa, Southern Europe, Syria, Persia, and Afghanistan, and is cultivated in France, Russia, Germany, Spain, and China, and also to a slight extent in England, where its growth is said to date from the middle of the 16th century. Some 20 or 30 years ago Liquorice was cultivated in market gardens in the neighbourhood of London, especially about Kew and Isleworth, and more recently at Mitcham. At the present time Yorkshire produces the larger quantity of English-grown root, and the principal seat of its culture is in and around Pontefract. Its cultivation in this particular neighbourhood dates back several generations, the deep, rich, loamy soil which occurs here being specially suited to the growth of the plant. The bulk of the Liquorice gardens are situated on the fertile slopes east and north-east of the town, the country between Pontefract and Knottingley being largely occupied by market gardens, in which Liquorice forms an extensive crop. The following notes on the cultivation of the plant and harvesting the root are taken from an article on the "Culture and Preparation of Liquorice" which appeared in the *Leisure Hour* for April 1893 :—

"The plants are grown in rows, and they stand from three to four years before arriving at perfection. The three years' growth is thinner and scarcely so rich in juice as the four years' plants. Occasionally, if the market is flat, the plants are allowed to grow a fifth season, but the root becomes thicker, coarser, and more woody. The long straight root goes down to a great depth, averaging perhaps about four feet, but sometimes even to six feet, and as the soil has to be dug down to this depth by hand to extract the root, the labour of cropping or harvesting is considerable. During the first two years that the land is occupied by liquorice, the plants themselves being small, allow of other crops being planted between the rows, and potatoes, and different varieties of cabbage, are mostly grown. The ground being earthed up around the liquorice plants, the furrows thus made afford much protection to the vegetable crops, and as the ground is always richly manured before planting liquorice, favourable conditions are thus ensured for the production of early and very superior vegetables, indeed it is said that the vegetable crops from a Liquorice plantation always command high prices in the Leeds markets. After the second year, however, the Liquorice plants grow to such a height, and spread their foliage so widely, that other crops will not grow beneath them. On a visit to Pontefract, namely, in the early part of September, the writer saw some of these Liquorice gardens where the plants had attained the age of five years and a height of about four feet, each plant sending up numerous straight stout stems from the rootstock or crown, each stem bearing large spreading alternate leaves, composed of a number of opposite leaflets of a bright green colour."

"The harvesting season is about the middle of September, and after the roots have been taken out of the ground by hand digging as before mentioned, they are stored in cool ventilated houses or cellars, usually in sand, until a favourable opportunity occurs for the process of dressing, which consists of trimming off all the fibrous rootlets, buds, and runners, or stolons. The fibrous roots are ground into liquorice powder, which is used as a medicine, and the buds and runners are carefully preserved in sand for planting, for it is from these alone that new plants are raised, and never from seed. The plants never being allowed to flower, do not of course produce seed. Flowering would deteriorate the value of the plant from a commercial point of view, as the juices would be consumed in perfecting the flowers, and the roots thus become useless. The planting of buds and runners for a new crop is done in the early part of April."

In Bentley and Trimen's *Medicinal Plants*, Vol. II., under Plate 74, it is stated that "both Spanish and Russian Liquorice roots are usually " imported in bales or bundles, or, rarely, in the case of that portion of " the Spanish variety which is derived from Alicante, loose, or in bags. " The Spanish Liquorice root is in straight unpeeled pieces, several feet " in length, and varing in thickness from a quarter of an inch to about " one inch. That from Alicante is frequently untrimmed and dirty in " appearance, but that from Tortosa is usually clean and brighter " looking. The Russian Liquorice root, which is imported from " Hamburg, is either peeled or unpeeled. It is in pieces varying from " 12 to 18 inches in length, and from a quarter of an inch to an inch " or more in diameter. Combined with the usual sweetness of " liquorice root, this variety has a feebly bitter taste."

The following correspondence and extracts from official reports give the latest information available as to the commercial production of Liquorice root in the East. A portion has already appeared in the *Kew Bulletin* for August of last year (pp. 223-4), but is reproduced here for the sake of completeness.

London Chamber of Commerce to Royal Gardens, Kew.

Botolph House, Eastcheap, London, E.C.,
27th February, 1890.

Dear Sir,

You will, perhaps, recollect my letter of the 8th January, containing certain inquiries in regard to Liquorice root, to which you were good enough to respond on the 13th ultimo, stating that you did not possess the details sought. Having troubled you in the matter, I have now pleasure in handing you a copy of a reply received from Vice-Consul D. R. Peacock, of Batoum, in case you may care to file it for future reference.

Yours, &c.,
D. Morris, Esq., (Signed) KENRIC B. MURRAY,
Royal Gardens, Kew. Secretary.

(Enclosure.)

Liquorice Root.

1. Is it necessary to acquire the right to dig roots in the lands where they grow, or is the digging of the root free to everybody?

The land yielding Liquorice root (chiefly in the district of Elizavetopol) being the property either of private people or the Crown, the right to dig roots must necessarily be acquired.

2. If the right has to be acquired, in what form is this done now, and what is the cost of such acquisition?

The right is generally acquired by a contract made with the proprietors, or, in the case of Crown lands, with the native villagers enjoying the usufruct of same. Land, however, situated at a certain distance from the railway stations or the villages are practically quite open, and though on legal ground the right of digging root in such lands would also have to be secured by contract, the cost of such would be trifling as compared with that for lands lying close to the railway stations. The actual cost of the acquisition of the right to dig roots is about from 1*l.* 10*s.* to 2*l.* 10*s.* per acre, in consideration of which the whole tract of land belonging to the same district is for digging purposes not let to other parties, the contractor securing for a certain period a sort of monopoly.

3. Are the labourers who dig the root hired by the day, or are they paid by weight for the root dug?

Diggers are paid by weight.

4. If paid by the day please state amount of daily wages and average quantity of root dug per day.

See previous reply. The average quantity of root dug per day by one labourer is about 4½ poods, or 1½ cwt.

5. If paid by weight please state the amount paid per pood.

The amount paid per pood (36 lbs.) is in the average 18 copecks, or about 1*s.* 2*d.* per cwt., on delivery at railway stations. Wages vary from 40 to 60 copecks per day.

6. How many pounds of dry root are obtained from 100 poods of fresh root on an average?

On the average 45 poods of dry root are obtained from 100 poods of fresh root.

7. What is the cost of the transport from the lands where the roots are dug to Baku?

The cost of the transit to Baku of course varies according to the distances from the different railway stations to that place, at the rate of $\frac{1}{40}$ copeck per pood and verst.

8. What is the railway freight from Baku to Batoum?

The railway freight from Baku to Batoum would thus be about 21 copecks per pood.

9. What taxes, &c., are imposed by the Government and local authorities?

There are no taxes. The person engaged in the industry or trade must take out a certificate of the Guild, the cost of which is the same as that for any other corresponding industry or trade in the Russian Empire.

EXTRACT from a REPORT by Major-General T. E. Gordon on a journey from Tehran to Karun and Mohamrah.

[F. O. Misc. Ser., 207, July, 1891, p. 15.]

I observed the Liquorice plant flourishing in great luxuriance and abundance on the Burujird and Khoremabad plains and in the intervening valleys, and I heard of the plains at Kermanshah being similarly covered with it. I saw it again at Shuster, but not in plenty, and I was told there was not much of it lower down in the Karun valley. But Mr. Macqueen was to observe on his land journey up from Mohamrah, and is to let me know. The root is greatly in demand in America for use in preparation of quid tobacco and fancy drinks, but until the large supply in Asia Minor available yet near railways and steamers is exhausted, the cost of carriage from the localities I have mentioned would kill all chance of profit at present prices. The plant is found in some abundance near Korna, at the junction of the Euphrates and Tigris, and a French firm collects the root there, sending it by water to Busrah, to be baled in Messrs. Gray Pauls' presses for export to Marseilles. The short distance from Korna to the port of sea shipment, 40 miles, just makes the business pay, but comparatively little is done in it as yet.

EXTRACT from REPORT of Statistician of United States Department of Agriculture, June 1893.

"The inhabitants of Elizabethpol and Baku, in the Caucasus, derive considerable benefit from Liquorice, which grows wild, needs no cultivation, and multiplies spontaneously. In 1878 two Greeks turned their attention to the large quantities of Liquorice in Caucasia; in 1886 they erected a large factory for drying and preserving the liquorice, which they annually export to America. The remunerative trade soon attracted others, and to-day there exist four prominent commercial houses which carry on a wholesale trade in Liquorice, and two of which have erected extract factories in this country. Annually there are produced about 108,339,000 pounds of raw Liquorice, which, after drying, yield 36,113,000 pounds of marketable merchandise. For raw Liquorice the factories pay on the average fivepence halfpenny per 100 pounds."

EXTRACT from REPORT on the Trade of Aleppo.

[F. O. 1893. Annual. No. 1,200.]

Liquorice root has largely developed, and merits special attention. Collection is now made on a large scale throughout the province, thus compensating in some degree the peasantry for the losses caused by bad harvests. 6,145 tons, valued at 43,231*l.*, were exported to the United States, as compared with 4,293 tons, valued at 28,077*l.*, in 1891.

RETURN of the Export of Liquorice Roots from Alexandretta (Port of Aleppo) during the years 1892–1.

1892.		1891.	
Quantity.	Value.	Quantity.	Value.
Tons.	£	Tons.	£
6,145	43,231	4,293	28,077

EXTRACT from F. O. REPORT, 1893. Annual, No. 1225, p. 12.

RETURN of the Export of Liquorice Root and Paste from Barcelona to Foreign Countries during the year 1892.

To Great Britain.		To other Countries.		Total.	
Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Tons.	£	Tons.	£	Tons.	£
6·86	357	100·95	2,416	107·81	2,773

EXTRACT from F. O. REPORT, 1893. Annual, No. 1254, p. 4.

RETURN of the Export of Liquorice from Smyrna during the year 1892.

Articles.	—	England.		Total Exports.	
		Quantity.	Value.	Quantity.	Value.
			£		£
Liquorice roots -	Bales -	—	—	70,705	62,220
,, paste -	Boxes -	3,214	14,142	5,128	22,563

EXTRACT from REPORT on the Trade of Damascus.

[F. O., 1893. Annual, No. 1261, p. 2.]

The only business which Damascus may be said to have lost is the Liquorice trade, which has practically died out, owing to the discovery of a better quality of root in Northern Syria, in Asia Minor, and elsewhere.

EXTRACT from F. O. REPORT, 1893. Annual, No. 1278, p. 12.

TABLE showing Exportation of Liquorice from Bilbao to Foreign Countries during the year 1892.

Articles.	To							Total.
	France.	England.	Belgium.	Holland.	Germany.	Italy.	Other Nations.	
Extract of Liquorice.	—	Tons. Cwts. 16 5	—	—	—	—	—	Tons. Cwts. 16 5

EXTRACT from REPORT for the year 1892 on the Trade of Baghdad and Bussorah.

[F. O. 1894. Annual Series, No. 1320, pp. 7-8.]

Liquorice root is obtainable in large quantities on the banks of the Tigris, and considerable expansion in the trade may be looked forward to, being in good demand in America for manufacture of tobacco.

CCCLXXVIII.—FLORA OF ALDABRA ISLANDS.

In the *Kew Bulletin* (1893, p. 152) some particulars are given of the Aldabra Islands; and mention is also made of the miscarriage of a collection of dried plants made there by Dr. W. L. Abbott, an American naturalist. Since then the plants have been received from the United States National Museum, and Mr. J. G. Baker, F.R.S., the Keeper of the Herbarium, has worked them out. A list of all the species follows, with descriptions of the novelties. The latter are more numerous than might have been expected, considering the area and altitude of the islands; but they all belong to genera characteristic of or common in the flora of Tropical Africa and the Mascarene islands, and some or all of them may yet be found in some other of the small islands or in Madagascar. The shrubby *Euphorbia Abbottii* is the most striking of the novelties. The plant alluded to by Dr. Abbott, in his letter published in the place cited above, as a sort of *Aloe*, and the most conspicuous plant in the islands, is *Lomatophyllum borbonicum*, Willd., previously only known from Bourbon and Mauritius. It is noteworthy that the collection does not contain a single fern, grass, or orchid, nor any member of the *Compositæ*.

List of the Plants, with their Geographical Distribution and Descriptions of the new Species.

CAPPARIDEÆ.

1. **Cleome (Polanisia) strigosa**, *Oliv.*—Mozambique, Zanzibar, and Glorioso group of islands.

2. **Capparis galeata**, *Fres.*—Tropical Africa, Egypt, Arabia, India. Nearly allied to the common Mediterranean and Oriental *C. spinosa*.

PORTULACEÆ.

3. **Portulaca quadrifida**, *Linn.*—Tropical regions of the Old and New Worlds.

MALVACEÆ.

4. **Sida spinosa** *Linn.* var. (*S. pusilla*, Cav.).—Tropical regions of the Old and New Worlds.

5. **Abutilon indicum**, *G. Don.* var.—Recedes from the type by its more shrubby stem and muticous carpels. A native of Tropical Asia, now widely spread in Africa and elsewhere.

TILIACEÆ.

6. **Grewia aldabrensis**, *Baker*, n. sp.; fruticosa, ramulis gracilibus glabris, foliis distincte petiolatis oblongis acutis crenatis triplinerviis utrinque viridibus glabris, cymis paucifloris axillaribus pedunculatis, bracteis lanceolatis, pedicellis flori æquilongis vel longioribus, sepalis lanceolatis dorso tomentosis, petalis oblanceolatis obtusis calyci æquilongis, fructu 4-lobato carpellis oblongis sinu apicali cuneato.

Folia 1–2 poll. longa. *Sepala* et *petala* 3 lin. longa.

Nearly allied to the Cape and Tropical African *G. occidentalis*, Linn., and the Madagascar *G. picta*, Baill.

Of this genus there are more than 50 species in Madagascar. From Tropical Africa 35 species are described by Dr. Masters in Oliver's *Flora*, and several others have since been added.

ZYGOPHYLLEÆ.

7. **Tribulus terrestris**, *Linn.*—Warmer regions of the Old and New Worlds.

SIMARUBEÆ.

8. **Suriana maritima**, *Linn.*—Tropical shores of both hemispheres.

OCHNACEÆ.

9. **Ochna ciliata**, *Lam.*—Widely spread in Madagascar.

CELASTRACEÆ.

10. **Celastrus senegalensis**, *Lam.*—Tropical Africa, Mediterranean region, India.

RHAMNACEÆ.

11. **Colubrina asiatica**, *Brongn.*—Polynesia and Tropical Asia to Madagascar, the Cape, and South-East Tropical Africa.

12. **Scutia Commersoni**, *Brongn.*—Tropical Asia, Madagascar, Mauritius, Bourbon, and the Cape.

SAPINDACEÆ.

13. **Schmidelia africana**, *DC.*—Widely spread in Tropical Africa.

LEGUMINOSÆ.

14. **Tephrosia purpurea**, *Pers.*—Cosmopolitan in the Tropics.

15. **Abrus precatorius**, *Linn.*—Cosmopolitan in the Tropics.

16. **Cassia mimosoides**, *Linn.*—Cosmopolitan in the Tropics, probably native only in the Old World.

17. **Desmanthus commersonianus,** *Baill., Atlas Plant. Madag.* tab. 23. Madagascar. This genus is divided between America and Madagascar. Four species have now been found in Madagascar, and there are 10 in America.

18. **Albizzia fastigiata,** *E. Meyer?* (leaves only).—Tropical Africa and the Cape.

RHIZOPHOREÆ.

19. **Rhizophora mucronata,** *Lam.*—The common Mangrove of the shores of the Old World, from Polynesia through Tropical Asia to East Tropical Africa and Natal.

COMBRETACEÆ.

20. **Terminalia Fatræa,** *D.C.*—Madagascar, from the north to the very south of the island. *Fatré* is its native name.

LYTHRARIEÆ.

21. **Pemphis acidula,** *Forst.*—Tropical shores from Polynesia through Tropical Asia to East Tropical Africa.

RUBIACEÆ.

22. **Oldenlandia corymbosa,** *Linn.*—Cosmopolitan in the Tropics.

23. **Pavetta trichantha,** *Baker*, n. sp.; fruticosa, ramulis sursum pubescentibus, stipulis deltoideis, foliis breviter petiolatis subcoriaceis oblongis obtusis basi rotundatis facie glabratis, dorso presertim ad venas primarias persistenter pilosis, floribus dense corymbosis ramis ramulisque pilosis, bracteis lanceolatis, calyce tubo campanulato piloso dentibus parvis deltoideis, corollæ tubo cylindrico piloso calyce duplo longiori lobis oblongis tubo brevioribus, fructu globoso biloculari, seminibus compressis nitidis.

Folia 2–2½ poll. longa, 15–18 lin. lata. *Calyx* ½ lin. longus. *Corolla* 2 lin. longa. *Fructus* 1½–2 lin. longus.

This genus is confined to the Old World, and is represented by 25 species in Tropical Africa, and 10 in India.

24. **Tricalysia cuneifolia,** *Baker*, n. sp.; fruticosa, glabra, stipulis deltoideis, foliis breviter petiolatis subcoriaceis oblongis acutis basi cuneatis, floribus in axillis foliorum fasciculatis subsessilibus, bracteis pluribus coriaceis late ovatis obtusis, calyce campanulato ore subintegro, corollæ tubo infundibulari calyce vix longiori, lobis ovatis tubo æquilongis, fructu globoso pedicellato.

Folia 2–2½ poll. longa, medio 9–14 lin. lata. *Corolla* 2–2½ lin. longa. *Fructus* 2 lin. diam.

Of this genus, including *Kraussia* of Harvey, which is joined with it by Hiern, there are 21 species in Tropical Africa.

25. **Psychotria,** species not identified. The specimens do not show the character of the corolla.

GOODENIACEÆ.

26. **Scævola Koenigii,** *Vahl.* Shores, Polynesia through Tropical Asia to Mauritius and Madagascar.

PLUMBAGINEÆ.

27. **Plumbago aphylla,** *Bojer.* Rare in Madagascar. Discovered long ago by Bojer at St. Augustine's Bay, and re-found lately by Scott

Elliot in the extreme south of the island. On Europa Island, which lies a short distance within the Tropic, midway between Madagascar and the mainland, Speke says, "it covers densely the whole island, taking "the place of grass or heather at home." It differs from the other Plumbagos by being entirely destitute of leaves.

OLEACEÆ.

28. **Jasminum mauritianum,** *Bojer.* Mauritius, Seychelles, and widely spread in Tropical Africa.

MYRSINEÆ.

29. **Myrsine cryptophlebia,** *Baker*, n. sp.; fruticosa, ramulis glabris, foliis coriaceis obovatis obtusis basi cuneatis glabris venis immersis occultis, floribus ad ramos infra folios solitariis vel paucis fasciculatis, pedicellis brevissimis, calycis lobis late ovatis imbricatis, corollæ lobis oblongis, calyce 2–3-plo longioribus, staminibus inclusis, ovario ovoideo, stylo brevi.

Folia 1½–2 poll. longa, 12–14 lin. lata. *Corolla* 1½ lin. longa. *Fructus* ignotus.

APOCYNEÆ.

30. **Vinca rosea,** *Linn.*—Now cosmopolitan in the Tropics.—Native in America.

ASCLEPIADEÆ.

31. **Sarcostemma viminale,** *R. Br.*—Cape, Tropical Africa, Mauritius. This also is entirely destitute of leaves.

32. **Astephanus arenarius,** *Dcne.*—Madagascar.

33. A species of this order from Assumption Island, south of Aldabra, without flowers, with the habit of a *Tylophora*, but the genus of which is quite uncertain.

BORAGINEÆ.

34. **Cordia subcordata,** *Lam.*—Polynesia to Zanzibar and Mozambique.

CONVOLVULACEÆ.

35. **Ipomœa (Calonyction) grandiflora,** *Lam.*—Polynesia, through Tropical Asia to East Tropical Africa.

36. **Evolvulus alsinoides,** *Linn.*—Cosmopolitan in the Tropics.

SOLANACEÆ.

37. **Solanum aldabrense,** *Wright*, n. sp.; fruticosum ramosum, caule tereti lignoso spinis parvis recurvis armato, foliis petiolatis ovatis sinuatis basi acutis utrinque pilis stellatis spinisque parvis vestitis, inflorescentiâ prope apicem ramorum subumbellatâ floribus paucis longipedicellatis, calyce campanulato extus dense stellatim tomentoso dentibus 5 brevissimis, corollâ rotatâ extus stellatim tomentosâ intus glabrâ lobis 5 oblongis acutis, staminibus 5 filamentis brevibus antherisque subulatis secus connectivum pubescentibus, ovario plus minusve bilobato glabro, stylo elongato apice curvato staminibus longiore.

Folia 1 poll. longa, 9 lin. lata. *Petiolus* 6 lin. longus. *Calyx* 2 lin. longus. *Corollæ* lobi 5 lin. longi, 2 lin. lati. *Antheræ* 2 lin. longæ. *Stylus* 4 lin. longus.

A more robust plant than *S. hastifolium*, Hochst., its nearest ally, from which it also differs in having more numerous spines on the stem, petioles, and leaves, the leaves more densely tomentose, the calyx less deeply lobed, and the corolla lobes broader.

ACANTHACEÆ.

38. **Hypoestes aldabrensis**, *Baker*, n. sp.; perennis, e basi ramosissima ramis gracilibus glabris, foliis parvis breviter petiolatis oblongis integris basi cuneatis, floribus dense glomeratis involucro cylindrico bracteis oblanceolatis apice herbaceis pilosis, corollæ albæ tubo cylindrico involucro paulo longiori, limbo parvo.

Nearly allied to the Madagascar *H. adscendens*, Nees. The genus is concentrated in Madagascar, about 25 species now being known in the island.

VERBENACEÆ.

39. **Avicennia officinalis**, *Linn.*—Mangrove swamps from Polynesia to East Tropical Africa, constantly associated with *Rhizophora mucronata.*

40. **Clerodendron minutiflorum**, *Baker*, n. sp.; fruticosum, erectum, ramulis apice pilosis, foliis distincte petiolatis ovatis integris acutis utrinque viridibus glabris, cymis densis, terminalibus, ramulis pilosis, pedicellis brevibus, calyce tubo campanulato dentibus deltoideis minutis, corollæ tubo cylindrico calyce subtriplo longiori, limbi lobis parvis obtusis, stylo longe exserto, fructu globoso glabro.

Folia 2–3 poll. longa. *Calyx* floriferus 1 lin. longus. *Corollæ* limbus expansus 1 lin. diam. *Fructus* 2 lin. diam.

Near the Cape and Tropical African *C. glabrum*, E. Meyer.

NYCTAGINEÆ.

41. **Boerhaavia diffusa**, *Linn.*—Spread through the Tropical regions of the Old World.

AMARANTACEÆ.

42. **Achyranthes aspera**, *Linn.*—Cosmopolitan in the Tropics.

EUPHORBIACEÆ.

43. **Euphorbia (Goniostema) Abbottii**, *Baker*, n. sp.; fruticosa, ramis teretibus inermibus, stipulis integris pulvinatis, foliis ad ramorum apicem confertis oblongis acutis ad petiolum brevem alatum angustatis, cymis dichotomis oligocephalis pedunculatis, bracteis ovatis, pedicellis erectis involucro longioribus, involucro campanulato bracteis 2 ovatis foliaceis persistentibus stipato, glandulis marginalibus orbicularibus integris, antheræ cellulis divaricatis, capsulæ carpellis orbicularibus.

Folia 2 poll. longa, 6–7 lin. lata. *Involucrum* 1½ lin. latum et longum. *Capsula* 3 lin. diam.

Nearly allied to the Mauritian *E. pyrifolia*, Lam., and the Rodriguez *E. daphnoides*, Balf. fil.

The section to which it belongs is entirely confined to the Mascarene Isles.

44. **Phyllanthus anomalus**, *Mull. Arg.*—Mauritius, Madagascar, Comoro Isles, and East Tropical Africa.

45. **Claoxylon**, near **C. indicum**, *Hassk.*—Not identified, but material not complete enough to describe.

URTICACEÆ.

46. **Ficus nautarum,** *Baker.*—Mauritius and Seychelles.

47. **Ficus (Urostigma) aldabrensis,** *Baker*, n. sp.; ramulis gracilibus glabris, cortice brunneo, stipulis parvis lanceolatis, foliis ad ramorum apices confertis subcoriaceis breviter petiolatis oblongis obtusis basi rotundatis facie glabris dorso obscure pubescentibus, venis primariis parallelis erecto-patentibus, venulis subtilibus copiose anastomosantibus, receptaculis parvis globosis sessilibus glabris, bracteis parvis receptaculo occultis.

Folia 12–21 lin. longa, medio 6–9 lin. lata. *Receptaculum* 2½–3 lin. diam.

Near the Mauritian *F. rubra,* Lam.

LILIACEÆ.

48. **Lomatophyllum borbonicum,** *Willd.*—Mauritius and Bourbon. Not known in Madagascar or on the mainland of Africa.

49. **Dracæna reflexa,** *Lam.*—Tropical Africa, Madagascar, Mauritius.

50. **Asparagus umbellulatus,** *Sieb.*—Mauritius and Rodriguez. Not known in Madagascar or on the mainland.

CYPERACEÆ.

51. **Cyperus compactus,** *Lam.* (*C. stoloniferus,* Vahl.).—Tropical Africa and Mascarene Isles.

52. **Fimbristylis obtusifolia,** *Kunth.*—Common in all the Mascarene Isles.

CCCLXXIX.—CULTIVATION OF COCA IN INDIA.

The cultivation of Coca to supply the requirements of the Government Medical Departments in India appears to be in course of being established at the Government Cinchona Plantations at Mungpoo, Bengal. The following correspondence on the subject has appeared in the *Proceedings* of the Agri.-Horticultural Society of India, January-March 1893:—

J. GAMMIE, Esq., Acting Superintendent, Cinchona Cultivation, Bengal, to the SECRETARY TO THE GOVERNMENT OF BENGAL, Financial Department, Government Cinchona Plantation, Mungpoo, Kurseong.

SIR, May 20, 1892.

WITH reference to your office endorsement, No. 92, dated 6th January last, and your reminder, dated the 14th instant, concerning the manufacture of cocaine at the Government Cinchona Plantation, Sikkim, I have the honour to state that no experiments during the past year were made, as there are as yet no leaves to work upon.

During the year the stock of plants and cuttings has been raised to 3,600, of which 1,270 have been planted out at an elevation of 2,000 feet above the sea, and ground is now being got ready 600 feet lower down for another experimental plot. So far the plants look healthy, but their growth is slow, and they suffer somewhat from the cold in winter. There is but one old plant of *Erythroxylon Coca* on these plantations, all the others being 18 months old or less, and few of them over a foot in height, so that some time must elapse before leaves are available for manufacturing purposes on even an experimental scale. A few seeds of the plant have been got from Ceylon, Madras, and Calcutta, and the plants raised from them show at least two distinct types. These types will be carefully watched and compared with each other as regards hardiness, rapidity of growth, and yield of alkaloids.

A few Coca plants have been put out in different places by tea planters in the Darjeeling Terai, and I am given to understand that although the growth has been good, the leaves are so thin in texture that the yield in weight is not enccuraging, and the prices offered have been so disappointing that no extensions are being made, which is perhaps an extra reason for the Government persevering with the experiment on these plantations.

I have, &c.
(Signed) J. GAMMIE,
Acting Inspector.

Military Department, Government of India,
Fort William, December 20, 1892.

EXTRACT paragraph 30, of a Military (Stores) Letter from the Right Hon. the Secretary of State for India, No. , dated the 24th November 1892.

"30. The information contained in the enclosure to the paragraph under reply regarding the cultivation of the Coca plant for the manufacture of cocaine in India has been noted. With regard to the letter from the Acting Superintendent, Cinchona cultivation in Bengal, No. 2EC/I., dated 20th May 1892, it has been ascertained from Surgeon-General Sir Benjamin Simpson, K.C.I.E., that the fine sample of Coca leaves referred to in Dr. Macnamara's Report of 7th March 1890, a copy of which was forwarded to your Government with Military (Stores) Department, No. 19, of 10th April 1890, was grown in the Meenglas Tea Estate in the Dooars. It is, therefore, thought that the plant would flourish equally well, and perhaps better, at a lower elevation than the Sikkim Cinchona Plantation, and it would appear to be desirable to make the experiment."

By order, &c.
(Signed) J. M. KING-HARMAN, Colonel,
Deputy Secretary to the Government
of India.

CCCLXXX.—CEYLON COCA LEAVES.

IN the *Kew Bulletin*, 1889, pp. 1–13, an exhaustive account was given of the Coca plant, together with some interesting chemical notes respecting the yield of alkaloids obtained from the different sorts under cultivation in different parts of the world. It was shown that leaves from the Huanuco, *Erythroxylon Coca*, Lam., the typical plant, yielded the larger per-centage of crystallisable cocaine, while the Truxillo leaves from *E. Coca*, var. *novo-granatense*, yielded nearly, if not quite, as much total cocaine, but a large proportion of it was in an uncrystallisable form. Under these circumstances, it was suggested that the broad-leaved typical *Erythroxylon Coca* was better for general cultivation at high altitudes to yield crystallisable cocaine; but that the variety *novo-granatense*, distributed largely from Kew up to 1889, was better suited for cultivation at low elevations, to yield large crops of leaves "for use in pharmacy and for Coca wine."

Leaves of the typical (Huanuco) *Erythroxylon Coca* were received from Ceylon in 1888, and the best were found to yield 0·60 per cent. of crystallisable with no uncrystallisable alkaloid cocaine. These leaves had been grown at Dolosbagie, at an elevation of 2,300 feet.

We have recently received from Dr. Trimen, F.R.S., Director of the Royal Botanical Gardens, Peradeniya, a further supply of Ceylon Coca leaves, and these are of the Truxillo sort, and probably yielded by *Erythroxylon Coca*, var. *novo-granatense*. They were grown at the Heneratgoda Gardens, in the lowlands of Ceylon. These leaves were submitted to Mr. Alfred G. Howard, F.C.S., F.L.S., who has been good enough to furnish a result of his analysis. The dried leaves yielded crystallisable alkaloid, 0·56 per cent.; uncrystallisable alkaloid, 0·47 per cent.; total, 1·03 per cent. The total yield of alkaloid is larger than in any leaves examined by Mr. Howard in 1888 (see *Kew Bulletin*, 1889, p. 8), but the large proportion of uncrystallisable alkaloid fully agrees with the general character of Truxillo Coca.

The following correspondence gives further particulars respecting these Ceylon Coca leaves:—

MR. ALFRED G. HOWARD to ROYAL GARDENS, KEW.

Stratford, near London, E.,
June 6, 1893.

DEAR SIR,

I NOW have the pleasure to enclose the analysis of the Coca leaves you sent me on May 1st, as follows:—

Crystallised alkaloid	- - -	0·56 per cent.
Uncrystallised alkaloid	- - -	0·47 ,,
Total	- -	1·03 ,,

You will notice that the amount of uncrystallised alkaloid is large, and therefore would detract largely from their value from a commercial point of view.

I am sorry that I have not been able to let you have the result before, but I only finished it yesterday, as I was exceedingly busy all last month.

Yours, &c.
(Signed) ALFRED G. HOWARD.

John R. Jackson, Esq., A.L.S.

MESSRS. BURGOYNE, BURBIDGES & CO. to ROYAL GARDENS, KEW.

16, Coleman Street, London, E.C.,
July 25, 1893.

DEAR SIR,

IN reply to your favour of the 21st instant, I cannot give you a very favourable report of the position of Coca leaves at the present moment. Stocks in London, Liverpool, and on the Continent are large, and the demand at present is very slow. Good green Truxillo leaves are held for 8½*d.* per lb., and fair Huanuco range from 1*s.* 4*d.* to 1*s.* 6*d.*, according to quality.

I remain, &c.
(Signed) H. ARNOLD.

John R. Jackson, Esq.,
Royal Gardens, Kew.

CCCLXXXI.—SUGAR-CANE DISEASE.

(*Continuation.*)

The following communication is printed in continuation of the information given in the articles in the *Kew Bulletin* for July 1893, and March last:—

ROYAL GARDENS, KEW, to COLONIAL OFFICE,

SIR, Royal Gardens, Kew, March 12, 1894.

I HAVE the honour to inform you that I have received a copy of the Supplement to the *Leeward Islands' Gazette* for January 11, 1894, containing " A Report on Diseases affecting the Sugar-cane in Barbados," by Mr. C. A. Barber, F.L.S., the Superintendent of Agriculture.

2. In this paper, on p. 108, Mr. Barber states:—" The fungus " (*Trichosphæria*, which is the cause of the most serious disease) has " been detected in specimens in the Kew Herbarium forty years old " from the West Indies, and we may therefore at once assume that it " is no recent importation." I think it is important to point out, for the information of the West Indian Governments interested in the matter, that this statement is founded on a mistake. There is no evidence at Kew of the existence of this particular disease in the West Indian sugar-fields prior to 1892. There is a specimen at Kew of sugar-cane, collected in Mexico forty years ago, attacked by the moth-borer, and this may be what Mr. Barber has in his mind.

3. The evidence, in my opinion, goes to show that the *Trichosphæria* has made its appearance quite recently in the West Indies, and I have little doubt that it has been introduced from the Old World. The importance of clearly recognising the actual fact can hardly be over-rated. It is obvious that if the disease has existed comparatively unnoticed in the West Indies for forty years, it is unlikely to suddenly assume the dimensions of a scourge. If, on the other hand, it is a comparatively recent introduction, the possibilities of the mischief it may effect have still to be measured. I am, &c.

(Signed) W. T. THISELTON-DYER.

Edward Wingfield, Esq., C.B.,
Colonial Office, Downing Street, S.W.

CCCLXXXII.—NEW ORCHIDS. DECADE 8.

71. **Pleurothallis inflata**, *Rolfe*; caule erecto tereti, foliis lanceolatis acuminatis, floribus solitariis pedicellatis, bracteis tubulosis apice obliquis acutis, sepalo postico lanceolato acuto, lateralibus connatis inflato-ventricosis apice minutissime bidenticulatis, petalis ovato-lanceolatis acuminatis, labello late cordato apiculato infra medium reflexo auriculis erectis disco lævi, columna brevi clavata.

HAB.—United States of Columbia.

Caules 6–8 poll. alti. *Folia* 5–6 poll. longa, 1–1¼ poll. lata. *Pedicelli* 1–1½ poll. longi. *Bracteæ* 3 lin. longæ. *Sepala* 6–7 lin. longa. *Petala* 5½ lin. longa. *Labellum* 2 lin. longum, 2½ lin. latum. *Columna* 1¼ lin. longa.

This species was introduced by Messrs. F. Sander & Co., of St. Albans, with whom it flowered in September 1891, and subsequently at

Glasnevin and elsewhere. It is most nearly allied to *P. Lindeni*, Lindl., belonging to the section *Macrophyllæ racemosæ*, but the racemes are apparently always reduced to a single flower. It also bears much resemblance to *P. ruberrima*, Lindl., of the section *Macrophyllæ fasciculatæ*, though the flowers are not fascicled. The three are quite distinct, if obviously allied, agreeing in the ventricose character of the united lateral sepals, and the peculiar shape of the lip. The new species, strictly speaking, will not go into either group, being neither racemose nor fascicled. It has semi-translucent whitish flowers with some purple spots and streaks on the sepals and petals.

72. **Dendrobium sanderianum**, *Rolfe ;* caule erecto elato distichophyllo, foliis ovato-oblongis inæqualiter et minute bidentatis, fasciculis axillaribus 2–3-floris, bracteis ovatis subobtusis minutis, pedicellis foliis longioribus, sepalis triangulato-ovatis acuminatis, mento inferne in sacculum subhemisphæricum inflato dein in calcare recto gracili producto, petalis suborbiculari-ellipticis apiculatis, labello trilobo lobis lateralibus parvis obtusis intermedio latissime obcordato apiculato crenulato, disco lævi, columna brevissima.

Hab.—Borneo.

Folia 1¾ poll. longa, ¾–1 poll. lata. *Bracteæ* 1 lin. longæ. *Pedicelli* 2 poll. longi. *Sepala* 1¼ poll. longa. *Petala* 1¼ poll. longa, 10–11 lin. lata. *Labellum* 1¾ poll. longum, 1½ lin. latum. *Mentum* 1 poll. longum. *Columna* 2 lin. longa.

This is a very beautiful species, which evidently belongs to the section *Formosæ*, yet it differs from every other in having the base of the mentum inflated into a short sac, something like that of *D. Phalænopsis*, Fitzg., to which, however, it bears no other resemblance. It is most like *D. Dearei*, Rchb. f., though the flowers are larger, the lip far broader, entire, and with a light purple stain instead of pale green at the base, the ovary not triquetrous, and the habit quite different. The stems continue to elongate and to throw out a succession of flowers for a long period, and eventually reach a length of three feet or more. The flowers are white, with the exception of a light purple stain at the base of the lip. It was introduced by Messrs. F. Sander & Co., St. Albans, and flowered in their establishment last autumn.

73. **Dendrobium glomeratum**, *Rolfe ;* pseudobulbis elongatis demum sulcatis, foliis . . . deciduis, floribus axillaribus in racemum brevissimum laxum congestis, bracteis oblongo-lanceolatis acuminatis reflexis imbricatis, sepalo postico oblongo subobtuso, lateralibus ovato-oblongis subobtusis basi cum pede columnæ in mentum elongato-conicum subincurvum productis, labello cuneato-obovato obtuso apice margine inflexo denticulato, disco lævi, columna brevi latissimo pede elongato.

Hab.—Moluccas.

Pseudobulbi 2–2½ ped. longi. *Racemi* 4–6 lin. longi. *Bracteæ* 6 lin. longæ. *Pedicelli* 10–12 lin. longi. *Sepala* et *petala* 8 lin. longa. *Labellum* 10–11 lin. longum. *Mentum* 8 lin. longum. *Columna* 2 lin. longa.

This species belongs to the section *Pedilonum*, and may be placed near *D. cumulatum*, Lindl., from which, however, it differs in having much larger flowers, arranged in a very short congested raceme with large imbricating bracts, and an orange-vermilion lip without an erect tooth at its base. Thus the habit is nearer that of *D. erythroxanthum*, Rchb. f., a small-flowered Philippine species. The present species has flowers from 1¼ to 1½ inches long, borne several together in loose axillary heads; the sepals and petals bright rose-colour, and the lip orange-vermilion. The lip is infolded at the apex, and the margin erose-denticulate. It was imported by Messrs. James Veitch & Sons, of Chelsea, and flowered in their establishment last December.

74. **Thunia brymeriana**, *Rolfe;* pseudobulbis cylindricis elongatis foliatis, foliis sessilibus oblongo-linearibus acutis v. acuminatis glaucis, racemis terminalibus arcuatis paucifloris, bracteis valde concavis oblongo-lanceolatis acutis, floribus speciosis, sepalis oblongo-lanceolatis subacutis, petalis similibus paulo minoribus, labello cucullato elliptico-oblongo obtuso undulato fimbriato venis supra medium fimbriato-cristatis, calcare clavato obtuso, columna clavata apice alata.

HAB.—Burma.

Planta 1½–2 ped. alta. *Folia* 6–9 poll. longa, 1–1¼ poll. lata. *Racemus* 4 poll. longus. *Bracteæ* 1¼–2¼ poll. longæ. *Sepala* et *petala* 2–2¼ poll. longa. *Labellum* 1½ poll. longum, 1¼ poll. latum. *Calcar* 4 lin. longum. *Columna* 8 lin. longa.

This handsome species is an introduction of Messrs. F. Sander & Co., St. Albans, and flowered in their establishment in June 1892. A plant from the same source also flowered at Kew in the following year. It is allied to *T. marshalliana*, Rchb. f., and *T. alba*, Rchb. f. The sepals and petals are white, and the throat of the lip yellow with numerous radiating crimson purple veins extending to the margin.

75. **Cœlogyne Mossiæ**, *Rolfe;* pseudobulbis ovoideis diphyllis, foliis lanceolato-oblongis acutis paululo undulatis, scapis lateralibus erectis arcuatis 6–7-floris, bracteis cucullatis oblongo-lanceolatis acutis striatis, floribus speciosis, sepalis elliptico-oblongis subacutis carinatis, petalis conformibus ecarinatis, labello trilobo lobis lateralibus erectis apice triangulato-ovatis obtusis intermedio elliptico subobtuso, disco bicarinato nervo medio vix incrassato carinis integris, columna clavata arcuata alata.

HAB.—Nilghiri Mts.

Pseudobulbi 1¼–1¾ poll. longi. *Folia* 6–7 poll. longa. *Scapus* 6–7 poll. longus. *Bracteæ* ¾–1¼ poll. longæ. *Sepala* et *petala* 1 poll. longa. *Labellum* 10 lin. longum. *Columna* 7 lin. longa.

A handsome species sent to Kew for determination by John S. Moss, Esq., Wintershill, Bishops Waltham, Hants, in June 1890, with the information that he had received it with other orchids from a friend in the Nilghiri Hills. It is allied to *C. nervosa*, A. Rich., and *C. glandulosa*, Lindl., but among other characters is readily distinguished by its perfectly entire keels, of which the lateral pair alone are developed. The scapes are produced from the young growths, which afterwards produce the leaves and pseudobulb. The flowers are white with a light yellow crescent-shaped marking in front of the keels.

76. **Cattleya Brownii**, *Rolfe;* pseudobulbis gracilibus elongatis diphyllis, foliis elliptico-oblongis obtusis coriaceis, spatha conduplicata lineari-oblonga obtusa, pedunculo 2–5-floro, bracteis triangulato-ovatis acutis, floribus speciosis, sepalis oblongo-lanceolatis subacutis lateralibus subfalcatis, petalis oblanceolato-oblongis obtusis undulatis subfalcatis basi attenuatis, labello trilobo lobis lateralibus amplis apice obtusis intermedio suborbiculari v. late orbiculari-ovato emarginato crispulo-undulato, disci venis paululo incrassatis, columna clavata arcuata.

HAB.—Brazil; prov. Minas Geraes.

Pseudobulbi 1½–2½ ped. longi. *Folia* 6–9 poll. longa, 2½–3 poll. lata. *Pedunculi* 3–4 poll. longi. *Bracteæ* 2–3 lin. longæ. *Sepalum posticum* 2–2¼ poll. longum, 6 lin. latum; *lateralia* 1¼–1½ poll. longa. *Petala* 1½–1¾ poll. longa, 6–7 lin. lata. *Labellum* 16 lin. longum, 14–15 lin. latum, lobo intermedio 9 lin. lato. *Columna* 1 poll. longa.

This species was introduced by Messrs. F. Sander & Co., St. Albans, in whose establishment it flowered last autumn. It is a tall plant, nearly allied to *C. Harrisoniæ*, Batem. The flowers are borne in short racemes of two to five each; the sepals and petals rosy-purple, also the front lobe of the lip, while the side lobes are whitish, slightly suffused with light rosy mauve, and the disc yellowish white. The flowers are rather variable in colour, some being considerably darker than others.

77. **Epidendrum Hartii**, *Rolfe;* caule erecto gracili foliato, foliis linearibus subobtusis, panicula terminali ramosa, bracteis subulato-lanceolatis, pedicellis glabris, sepalis lanceolatis acutis, petalis linearibus basi subfiliformibus, labello trilobo lobis lateralibus transverse oblongis truncatis brevibus intermedio quadrato v. obovato-oblongo emarginato, disco bicarinato callo minuto interjecto, columna omnino adnata.

HAB.—Trinidad, common, *J. H. Hart.*

Caules 6–8 poll. alti. *Folia* 3–4 poll. longa, 2½–4 lin. lata. *Paniculæ rami* 4–5 poll. longi. *Bracteæ* 1 lin. longæ. *Sepala* et *petala* 4 lin. longa. *Labellum* 4½ lin. longum.

A dried specimen of this plant has been received for determination from J. H. Hart, Esq., F.L.S., Superintendent of the Trinidad Botanic Gardens, who notes it as "common." A plant also flowered at Glasnevin, under the care of Mr. F. W. Moore, in May 1890, its origin being unknown. It belongs to Lindley's group *Euepidendrum, Planifolia paniculata*, and is most allied to the New Granadan *E. purum*, Lindl. It bears lax panicles of whitish-yellow flowers.

78. **Ornithidium fragrans**, *Rolfe;* rhizomate valido scandente, pseudobulbis ovoideo-oblongis subcompressis basi di-triphyllis apice monophyllis, foliis lineari-oblongis subobtusis basi conduplicatis, floribus axillaribus paucis, pedicellis foliis dimidio brevioribus basi vaginatis, bracteis fere obsoletis, sepalis patentibus oblongo-linearibus subacutis, petalis subconniventibus lanceolato-linearibus acutis, labello subtrilobo lobis lateralibus parvis erectis rotundatis intermedio reflexo quadrato-oblongo truncato v. emarginato subtus carinato-dentato, disco infra medium callo obscuro reniformi instructo, columna brevi arcuata.

HAB.—Not recorded.

Pseudobulbi 1¾–2 poll. longi. *Folia* 4–6 poll. longa, ¾–1¼ poll. lata. *Sepala* 8 lin. longa. *Petala* 6 lin. longa. *Labellum* 5 lin. longum. *Columna* 3 lin. longa.

This species of Ornithidium flowered with Mr. F. W. Moore, A.L.S., at Glasnevin, in March 1893, and in the collection of Sir Trevor Lawrence, Bart., Burford, Dorking, in January of the present year. From the latter we learn that it was imported by Messrs. F. Sander & Co., of St. Albans. It is allied to the Mexican *Ornithidium densum*, Rchb. f., which has far more numerous flowers, of about a third the size, much more compressed pseudobulbs, and longer leaves. The flowers are whitish, faintly suffused with mauve-purple, and the front lobe of the lip dull mauve-purple. The flowers are fragrant, something like heliotrope.

79. **Oncidium brevilabrum,** *Rolfe;* pseudobulbis ovoideis subcompressis demum sulcato-striatis, foliis elongato-linearibus acutis, panicula ampla multiflora, bracteis parvis ovatis acutis, sepala anguste unguiculata spathulata obtusa, petala lati unguiculata limbo orbiculari-ovato obtuso, labello trilobo lobis lateralibus obovatis obtusis intermedio parvo triangulo subacuto crista oblonga multipapillosa, columna brevi decurva buccis magnis alis amplis dolabriformi-cuneatis crenulatis, rostello rostrato.

HAB.—Not recorded.

Pseudobulbi 2–2¼ poll. longi. *Folia* 8–12 poll. longa, 6–8 lin. lata. *Paniculæ* foliis longiores sed bene evolutæ non visæ. *Bracteæ* vix 1 lin. longæ. *Sepalum posticum* 4 lin. longum, *lateralia* 5 lin. longa. *Petala* 3 lin. longa. *Labellum* 2½ lin. longum, 5 lin. latum.

This species belongs to the section *Rostrata*, but is readily distinguished from others of the group by having the front lobe of the lip reduced to a small triangular body—in fact, nearly obsolete—while the side lobes are well developed. In this respect it is analogous with *O. barbatum*, Lindl., of the very different section *Tetrapetala barbata.* The flowers are numerous, about three-quarters of an inch in diameter, and bright yellow with a few narrow brown bars on the lower part of the segments. There are also a very few abortive flowers, in which the segments are reduced to minute linear-oblong yellow bodies. It was introduced by Messrs. Linden, L'Horticulture Internationale, Brussels, by whom it was sent to Kew in November last.

80. **Serrastylis,** *Rolfe* [Orchidearum genus novum]. Sepala æqualia, libera, subconniventia. Petala sepalis similia. Labellum ad basin columnæ sessile, erectum, trilobum, ecalcaratum. Columna brevis, superne paulo incrassata, apoda, antice biauriculata; clinandrium alatum, fimbriato-denticulatum; rostellum erectum, longissimum, subulatum, apice incurvum; anthera inter clinandrium opercularis, unilocularis, apice in appendicem longum producta; pollinia 2, inappendiculata, anthera dehiscente apici dilatato stipiti longissimo affixa; glandula parva.

Serrastylis modesta, *Rolfe;* pseudobulbis lineari-oblongis subteretibus monophyllis, foliis lanceolato-oblongis subobtusis coriaceis, racemis multifloris, bracteis lanceolatis acuminatis, sepalis lineari-lanceolatis acutis, petalis sepalis similibus, labello trilobo lobis lateralibus erectis oblongis obtusis apice reflexis intermedio elongato-lineari acuminato, disco inter lobos laterales obtuse carinato.

HAB.—Andes of New Granada.

Pseudobulbi 2¼ poll. longi. *Folia* 7 poll. longa, 2 poll. lata. *Racemi* 5 poll. longi. *Bracteæ* 3–4 lin. longæ. *Sepala* et *petala* 8–9 lin. longa. *Labellum* 5–6 lin. longum. *Columna* 2 lin. longa. *Anthera* et *rostellum* 2 lin. longum.

This very distinct orchid flowered in the collection of Sir Trevor Lawrence, Bart., Burford, Dorking, in February 1894, when it was sent to Kew for determination. It was obtained from Mr. J. O'Brien, of Harrow-on-the-Hill, who received it from Mr. F. C. Lehmann. In its vegetative organs it resembles a *Trichopilia*, and the raceme is like that of a *Brassia* though the flowers are totally different in structure with rather more spreading segments. The lip is strongly three-lobed, with short erect side lobes, which at first clasp the base of the column and then reflex, and a long narrow and acuminate front lobe. The column is rather short, with a fimbriate clinandrium somewhat like that of

Trichopilia, but with the addition of a pair of wing-like auricles in front, and a much elongated rostellum, pollinarium and anther-case. The latter organs resemble those of an *Ornithocephalus*, except that they are erect, not incumbent. It is therefore quite anomalous in structure, but, adopting the arrangement of the *Genera Plantarum*, can most conveniently be placed next to *Brassia*. The sepals and petals are light reddish-brown, margined with pale yellow, and the lip whitish yellow.

CCCLXXXIII.—AGRICULTURAL PROGRESS IN JAMAICA.

In the Annual Report of the Governor of Jamaica recently published (*Colonial Reports*, Annual, No. 103) an encouraging account is given of the agricultural and botanical results of the official year 1892–3. It is noticed that the exports of fruit now comprise 29·4 per cent. of the total exports of the Colony. Sugar comprises 13·1 per cent., and rum 11 per cent. Dyewoods, including logwood and fustic, comprise 21·3 per cent., while pimento and minor products account for 9·5 per cent. It is evident that Jamaica now possesses varied resources and is practically free from dependence on the one or two staple industries which have hitherto been regarded as essential to its prosperity. Cacao is one of the recently developed industries that is making excellent progress both as regards quantity and quality. The efforts which have been made to cultivate the vine for fresh grapes are very promising, though the results have not, as yet, appeared in the exports. The remarks made by the Governor on the work of the Botanical Department, under Mr. Fawcett, show that both in the island, as well as in this country, the efforts of the latter are fully appreciated.

Agriculture.

The fruit trade, which was referred to in last year's report as being in a depressed state, has somewhat recovered its former healthy condition, and the increase there spoken of in the crops of sugar and output of rum has been fairly maintained during the year under review.

The export of cocoa shows an increase of 3,010 cwt. in quantity and 8,896*l.* in value; coffee an increase of 10,378 cwt. in quantity and 3,726*l.* in value; bananas, 676,280 bunches and 76,843*l.* in value; oranges, 3,806,526 in number and 11,526*l.* in value.

The area of land in the island under cane and coffee cultivation has varied very little in recent years. There were during the year under review 32,466 acres in cane and 21,450 in coffee.

The cultivation of bananas has increased to 14,860 acres from 9,959 in the year 1890–91.

The total area under cultivation in the island was 666,741 acres, of which 499,053 was in guinea grass, pimento, and common pasture, against a total area of 1,958,678 acres of the whole island on which the property tax was collected.

Botanical.

The useful work annually performed by this department has continued during the year under review, and it will be seen from the following figures, showing the sale and distribution of plants at the different gardens, that the advantages offered by the Department to the general public are availed of to a considerable extent :—

Hope Gardens, plants sold	20,356
Castleton	3,868
Hill Garden	760
Total sold	24,984

Distributed free or in exchange	6,693
Sent to Hope Gardens for distribution	7,494
To Royal Gardens, Kew	37
Total distributed	14,224

The issue of the usual monthly Bulletins, which are supplied free of cost to residents in the island, and form a most useful means for the dissemination of information relating to plants, has been regularly carried out by the Department, the number distributed in the island being 675, while the circulation abroad amounts to 178.

The work of maintaining the gardens generally has been carried out in a satisfactory manner.

At the Hope Gardens it was not found possible to continue the work of extension during the year owing to want of funds, but the area under cultivation has been considerably improved. Trees have been planted in the different sections according to the geographical arrangement on which the plan of the garden has been laid down, and in the tropical African section a commencement has been made towards putting the whole place under Bahama grass, while the fern house, the rosery, the sugar cane plantation, and the economic section have all received careful attention at the hands of the Superintendent.

Experiments are being carried out with potatoes, onions, and fodder plants, and the budding of oranges on a small scale has been partially successful. The Sisal hemp plantation is flourishing.

The *Hill Garden* (*Cinchona*).—Experiments in the cultivation of peas have been carried on with generally satisfactory results, and the important question of suitable fodder plants for the higher elevations has been engaging the attention of the Department for some time, and it is to be hoped that the experiments now being carried out will have successful results.

The garden at *Castleton* has been maintained in its customary satisfactory condition, and, as usual, has been much frequented by visitors. Most of the plants in the rosery having become worn out by continuous cutting, a new bed has been prepared and planted. The stock of plants in the fern house and on the rockeries has also been considerably increased.

The *Kingston Public Garden* has continued to afford a means of pleasant recreation to the people of the city, who appreciate the weekly performances by the excellent band of the West India Regiment. Gates have been erected on the east and west sides of the garden, as was intended in its original design. The plants from the exhibition grounds have done well, and more have been brought from the Hope Gardens, still further improving the appearance of the grounds.

At *King's House* several improvements have been effected during the year, of which the formation of a vinery may be mentioned as the principal feature. A large number of cuttings of the best English vines were obtained, through the kind offices of the Director of Kew Gardens, from the Royal Horticultural Society's gardens at Chiswick, and from these 34,350 cuttings were produced and planted out for distribution later. Vines were also obtained by myself, and from Madeira by Dr. Grabham, who kindly presented them to the Department. The plan proposed last year for instruction in the cultivation of the vine has been carried out, and demonstrations have been frequently given by the Superintendent.

The *Library* has been added to during the year, and work in the Herbarium has been continued.

CCCLXXXIV.—COFFEE CULTIVATION IN ANGOLA.

In a Foreign Office Report (No. 1,333, Annual Series, 1894) Mr. W. Clayton Pickersgill, C.B., Her Majesty's Consul at Loanda, gives a descriptive account of the Portuguese Colony of Angola, on the south-west coast of Africa. The interior of this Colony, rising in a succession of terraces from the sea, consists of large tracts of fertile and well-watered country, and roads, somewhat rough, it is true, reach inland stations nearly 200 miles from the capital. Coffee plantations appear to flourish here on a large scale. It is not clear what kind of coffee is cultivated. The estates are said to have been established "by the " appropriation of forest in which coffee was growing wild or by uniting " patches already cleared by the natives." There are several species of coffee indigenous to West Africa. One of these, with very narrow leaves, *Coffea stenophylla* (see *Kew Bulletin*, 1893, p. 167), is cultivated to some extent on the hills at Sierra Leone. The Liberian coffee (*C. liberica*), also West African, is cultivated chiefly on coast lands. It is unlikely to flourish in the hilly districts of Angola. On the other hand, the Arabian coffee (*C. arabica*) may have been introduced long ago by Portuguese settlers and become naturalized in the country. In any case Mr. Pickersgill's description of the coffee estates and their circumstances at the present time will be read with interest:—

Crossing the Lucalla in a canoe, the traveller finds his path ascending to a seeming chaos of volcanic hills, and almost immediately he enters a fair, wild, wooded land of towering heights and echoing glens—the garden of Angola, and a veritable Eden compared with the dreary seaboard. A climbing ramble of three or four hours, amid scenes of refreshing beauty, carries him up to the valley of the highest crater—the loveliest of them all—watered by a perennial stream.

On his way he has seen coffee in blossom and berry, growing in jungle luxuriance, and has had glimpses of white plantation buildings, hidden amongst the green. Here he discovers a similar homestead—the storehouses, shop and dwellings, drying-grounds, engine-room, and distillery of an estate which is managed by two energetic young Englishmen. From a neighbouring summit—part of the crater's dizzy rampart—can be seen the headquarters of other properties in the valleys of Cazengo, which fall off east and west, while to the north extends Golungo Alto, a second volcanic jumble swathed in forest, concealing many more. Beyond again, in the same direction, lies the greater coffee district of Encoji; but that for the present is left unnoticed, as not being included in the strip of Angola, bounded by the Quanza and the Bengo, which is under survey.

Coffee Estates.

Altogether the estates of Cazengo and Golungo Alto number somewhere between 15 and 20. The largest of them—one of eight, which are in the hands of the Banco Nacional Ultramarino of Portugal—was described to the writer by the courteous and hospitable manager-in-chief of the mortgaged group as "six miles long and of breadth unknown," the map of it which he was engaged upon being then incomplete. Its crop for 1893 was estimated at 214 tons, and for the first time in the history of the property systematic planting had been undertaken, which was expected to result in the addition of 118,000 trees.

Origin.

Such information must needs provoke inquiry, and it becomes necessary to explain that all these estates have been created either by the appropriation of forest in which coffee was growing wild, or by uniting patches already cleared by natives, and old records exist which prove that many a birthright was bartered for something much less substantial than a mess of pottage. That the value of the holdings might be vastly increased is self-evident. One of the smallest, that which has been mentioned as managed by Englishmen, and which belongs to a British firm, is registered as covering 1,424 acres, but only 464 contain coffee. Of the remaining area 54 acres are given to cane, for the manufacture of rum, 64 to manioc, as food for the hands, and 1 to drying grounds, thus leaving 841 acres unproductive, except in so far as it yields fuel for the steam-power and distillery.

Management.

Then, again, the bean of this indigenous coffee is not only of very poor flavour, but also of very small size, and on account of the height of the trees and their straggling character is often hardly worth the trouble of picking. An acre of coffee, with the plants 6 feet apart and properly cultivated, is considered in other parts of the world good for a crop of half a ton. Under such conditions the 464 acres above referred to might be expected to bear at least 200 tons, whereas at present they only yield 35. There is no digging or manuring done on any of the properties. The trees are simply cleared of under-growth and pruned a little, in the roughest and readiest manner, and then left to do the best they can with such nutriment as rots on the surface around. But it is easier to indicate possibilities than to attain them, the problem exists in the usual terms of labour and management, and for those who can solve it the reward is fortune.

Coffee Prices.

Notwithstanding its inferiority, the coffee of Cazengo and Golungo Alto readily finds a market. In 1892 the total shipment from Loanda, consisting mainly of the crops of the two districts named, amounted to 4,805 tons, valued by the Customs at 209,609*l.*, and yielding to the Government a little over 6,000*l.* in duty. All of it went to the Tagus, and all in Portuguese vessels. The returns for 1893 are not yet obtainable; but everybody is of opinion that they will record a considerable increase; and it is a matter of certainty that the profits for the year will mount far beyond the average. The ill wind of Brazil is a favouring breeze on this side of the Atlantic. Coffee which was purchased in Cazengo at $3\frac{3}{4}$*d.* per lb., and which cost $1\frac{1}{4}$*d.* per lb. to bring to the port of shipment, has already been selling in Lisbon at 7*d.* per lb. The margin is satisfactory, and yet it shows that under ordinary circumstances there must be very little room to depend upon. In fact, the rate of exchange often makes all the difference between profit and loss. The best bargains may be utterly ruined by the vagaries of the unstable milreis, which to day is worth only 3*s.* $4\frac{13}{16}$*d.*; whereas six months ago its value was 3*s.* $7\frac{7}{8}$*d.* For this and other reasons merchants in Portuguese West Africa need a large capital and unbounded patience.

CCCLXXXV.—MISCELLANEOUS NOTES.

A New Edition of Johnson's Gardener's Dictionary.—The first edition of this useful work appeared in 1846, since when it has been issued in various forms, and two supplements have been made to it; but no thoroughly revised edition has appeared since 1863. The present edition, prepared by Mr. C. H. Wright, assistant in the Herbarium, and Mr. D. Dewar, formerly foreman of the Herbaceous Department at Kew, and now Curator of the Botanic Garden at Glasgow, is a great improvement on the preceding ones; and, from its portable size and moderate price, will doubtless be highly appreciated by all persons concerned in gardening.

Maragogipe Coffee.—This a large-growing variety of Arabian Coffee found in Brazil and introduced to this country by Mr. Thomas Christy, F.L.S., in 1883. The plant has been grown in the Palm House at Kew and this year it has produced a good crop of fruit. It is large and vigorous looking, having, at first sight, much of the habit of Liberian Coffee. The leaves though fully twice the size of those of Arabian Coffee have, however, the papery texture and the undulating character distinguishing that species. The flowers, also, are the flowers of *C. arabica*, and so are the cherries, except in size. The latter are nearly an inch long, red and soft when ripe with a silky smooth surface and a very small proportion of pulp. The chartaceous integument known as the "parchment skin," is thin as in Arabian Coffee and not hard and horny as in Liberian Coffee. The cleaned beans, before drying, form fully 30 per cent. by weight of the cherries, and in this respect Maragogipe Coffee is certainly very promising. From a culture point of view the heavy whippy branches may be a drawback as also the very long internodes showing a considerable amount of barren wood. When first introduced Maragogipe Coffee was described as follows: "It grows with extra- "ordinary vigour, and trees three to four years old were already eight "to ten feet high and full of fruit. The tree seems to come into full "bearing much sooner than the ordinary coffee and the bean is very "much larger . . . . the weight of coffee per acre must be very "much more than from the ordinary coffee tree." Although Maragogipe Coffee has been grown experimentally in Ceylon, Java, Jamaica, and Trinidad, no reports have so far reached Kew as to the results. In Ceylon and Java the fact that it was attacked, equally with Arabian Coffee, by the coffee-leaf fungus (*Hemileia vastatrix*) gave Maragogipe

Coffee no special advantage in those islands and possibly on that account it failed to receive attention. It is mentioned, however, in the *Tropical Agriculturist* (Vol. IV., p. 494), that a large quantity of seed was shipped to Ceylon direct from Brazil in 1884. As regards the West Indies, the Superintendent of the Botanic Gardens, Trinidad, mentions Maragogipe Coffee as one of the sorts cultivated at that establishment in 1887. At Jamaica seed was received in 1883 and about a dozen plants raised from it were distributed for trial amongst the leading planters in the Blue Mountain district during 1884 and 1885.

The following account is extracted from the *Transactions of the Queensland Acclimatisation Society* for June 1893 (p. 56) :—

"The demand for coffee plants during the past year has been on the increase, 5,956 plants having been sent from the gardens. These have been planted at various places along the coast, at Mackay, Bundaberg, Maryborough, Gympie, Maroochie, Mooloolah, Cleveland, &c. The kinds sent were varieties of the Arabian and a few plants of the *Maragogepie*, or Brazilian Coffee, have also been distributed. The imported plant of this fine coffee, originally introduced from Kew [*Report*, 1890, p. 14] growing in the society's gardens, is this season bearing heavily, and a large stock of plants will be raised from seeds for next year's distribution. Two hybrid coffee plants are also in full bearing this season. One of these plants has shown a distinct character; the cross was effected between the Mocha and the *Maragogepie*, the pollen from the latter being used to fertilise the Mocha."

Caragana Bark.—Amongst the numerous and interesting objects of vegetable origin collected by Surgeon-Major J. E. T. Aitchison at various times in the course of his travels in Afghanistan, and now deposited in the Museum of the Royal Gardens, are some stems of a species of *Caragana*, received so far back as 1879, the bark of which is remarkable for its smoothness and for its greenish bronze-like appearance. A note accompanies these specimens to the effect that the bark, in consequence of its metallic appearance, is used for making bands for sword scabbards. This species has since been described in a paper, "On the Flora of the Khuram Valley," published in the *Journal of the Linnean Society* (Vol. XVIII., p. 43) as *Caragana decorticans*, Hemsl., and referred to as "a large shrub in appearance of wood and "bark very like laburnam. The bark is employed by the Afghans in "the form of rings to slip over and hold the sheaths of the long knives "in position in lieu of brass work. The surface takes a good polish "and when new resembles bronzed leather. The wood is called "'Jirrel.'"

Notwithstanding the interest attached to the use of this bark it has not been possible until now to secure for the Kew Museum a knife and sheath bound with bands of the bark, and we are indebted to W. Merck, Esq., C.S.I., British Commissioner, Khuram, for having furnished us with an example.

Lathyras tuberosus tubers.—The Museum of the Royal Gardens is indebted to Messrs Veitch and Sons, of the Royal Exotic Nursery, Chelsea, for a good sample of the tuberous roots of *Lathyrus tuberosus*, L., a leguminous plant found in cornfields in several parts of Europe, and in this country in the county of Essex. The sample was accompanied by a memorandum from Mr. C. J. Barenburg of Arnheim, Holland, from which the following particulars are derived. The plant thrives well in Austria, Switzerland, and the greater part of France. In Holland it is found chiefly in the provinces of Guelder, Utrecht, Overysel, and Zealand, in the first three of which it grows wild, and the farmers do their utmost to extirpate it in consequence of its being very injurious to wheat and rye crops, exhausting the soil and clinging in its growth to the haulms. It is often so abundant as to make the cornfields quite bright with its flowers. In Zealand the plant is cultivated for the sake of the tuberous roots, either by leaving the smaller ones in the ground, when the larger ones are being dug up in autumn, or by sowing the seeds saved in March. The fresh tubers are outwardly of a blackish colour, and inwardly of a whitish fleshy texture. When cooked they are said to be a very wholesome food, and to have a flavour similar to a chestnut. To prepare them for food they should be first put into a bucket filled with water and rubbed with a piece of wood to remove the clay or soil and loosen the skin. They are then ready for boiling with the skin on in water; a handful of salt should be added to a quantity contained in an average sized pot. They require boiling for two hours or more, and when ready they are peeled and eaten with a little butter. In France, children of the lower class eat the raw tubers simply removing the skin before doing so.

Miss North's Gallery.—The collection of botanical pictures painted by the late Miss Marianne North in all parts of the world and presented by her with the building containing them to the Royal Gardens in 1882 was re-opened to the public on April 1, after being closed for the greater part of the winter. Some of the pictures had recently exhibited some slight indications of deterioration. The advice of Sir Frederick Leighton, the President of the Royal Academy, was therefore sought as to the best means to be adopted for their preservation.

Sir Frederick Leighton was so good as to make a careful examination of the whole collection. He reported on June 8, 1892:—

"Speaking broadly, they (the pictures) seem to me to be, with very few exceptions, in excellent condition. In a few of the studies certain colours have, I am told, began to fade. This can only be due to the nature of the pigments, for the source of light is not unduly powerful. . . . I noticed in the skies some deterioration of yellow tints, and this deterioration I should attribute to the pigments, and to no other cause. You see unfortunately innumerable instances of the same deterioration in Turner's skies."

Sir Frederick Leighton recommended that the pictures should receive, "to give full value to their tones and also for their protection, "a slight coat of varnish—mastic for choice, because it is removable." He further recommended that they should be glazed.

These recommendations having been adopted by the First Commissioner of Her Majesty's Works and Public Buildings, provision was made for the necessary cost in the estimate of 1893–4, and the work was taken in hand in the late autumn of 1893.

The whole of the pictures was taken down, and it was then found that they were simply painted on paper, with no protection at the back but a thin piece of cardboard. The frames were fastened to battens which were fixed to the walls of the building. As nearly all these walls are external, it was probable that in winter they became thoroughly chilled and some condensation of moisture upon them would then be inevitable. This would account for the "sagging" which the pictures frequently exhibited, and which would be explained by the paper absorbing moisture.

The preliminary treatment of the pictures was placed in the hands of Messrs. William Dyer and Sons, of 7, Mount Street, W., who are employed at the National Gallery. Under their advice the pictures were first firmly fixed down on the cardboard backs under pressure; they were then carefully washed, after drying covered with a thin coat of mastic varnish, and finally dried at a temperature of 60 degrees. They were then covered with glass in their original frames and protected at the back with a board. Both the glass and the board were carefully pasted over at their edges with paper so that each frame is now practically airtight.

With the view of leaving no precaution neglected for preserving to posterity so popular and valuable a collection, Her Majesty's Office of Works decided on further lining the whole of the gallery with matchboarding. Upon this the pictures were rehung in a more convenient way than had been originally employed.

Opportunity was taken at the same time by Her Majesty's Office of Works to make some necessary repairs in the gallery and to renovate the decorations.

At the back of the inner rooms facing the entrance a posthumous bust of Miss North has been placed. This is the work of Mr. Conrad Dressler, and is the gift of Miss North's surviving sister, Mrs. Addington Symonds.

Tropical Africa.—The Germans are very active in collecting plants in Tropical Africa, and the Herbarium has received considerable additions from these sources. Among them a set of about 1,000 species collected by Mr. C. Holst, in the Usambara country, in East Africa, situated in about the same latitude as Pemba Island. This collection was acquired by purchase, and contains a large number of new species, especially of trees and shrubs. Noteworthy among the new herbaceous plants are some new species of *Streptocarpus.* From the Cameroons we have a collection, also rich in novelties, collected by Dr. Preuss, and presented by Dr. A. Engler, the Director of the Royal Botanic Garden, Berlin. There are several new genera, including a remarkable one belonging to the *Aurantiaceæ ;* but as they have not yet been published it is undesirable to put their names on record here.

South Africa.—Professor Macowan, Government Botanist, Cape Colony, has presented the 15th and 16th centuries of the "*Herbarium Austro-Africanum,*" which was commenced by him and Mr. Harry Bolus, and is now continued by him alone. The specimens, as usual, are excellent, and include many rare and desirable previously known plants, besides a number of novelties. *Acanthosicyos horrida*, a leafless, spiny cucurbitaceous plant, native of the country near Waalvisch Bay, is one of the most interesting. This bears an excellent wholesome fruit in great profusion, in an almost absolutely rainless region ; but all attempts to cultivate it at Kew, as well as in the south of Europe, have failed. The rare *Arrowsmithia styphelioides* is also represented by good specimens.

Presentation to the Library.—Miss Catherine Sharpe, of the Grove, Hampstead, has presented a copy of the thirteenth edition of Linnæus's *Systema Naturæ.* This is not the genuine corrected thirteenth edition, edited by Gmelin, but one printed at Vienna in 1770, and a mere copy of the twelfth. It is on the same footing as the so-called third edition of Linnæus's *Species Plantarum*, also printed at Vienna.

Wheat Cultivation.—As far as the British Isles are concerned the cultivation of wheat is almost exclusively an English crop. The total acreage for the United Kingdom for 1893 was in round numbers two million acres (1,955,213). Of this England alone accounts for 1,798,869.

This is only about a quarter of the acreage in the Punjab alone, as given in the following report:—

DEPARTMENT OF LAND RECORDS AND AGRICULTURE, PUNJAB.
Dated Lahore, 27th February 1894.

Second Report on the Wheat Crop of the Punjab for 1893–94.

The area now estimated to be under wheat in the Province is almost exactly the same as that shown in the first forecast. The total is now 7,584,200 acres against 7,570,300 acres, a slight increase of 0·2 per cent. It is an excess of 4·4 per cent. over the figures given in the second forecast of last year, and of 6·5 per cent. over the figures of the final forecast. In Hissar the area is said to be 32 per cent. below that of last year, as the rainfall there was peculiarly favourable in 1892, and failed somewhat early in autumn of 1893. This is the only district which reports a material falling off from the figures of last year. Throughout the Province it may be said that the prospects of the crop are excellent. Sufficient rain has fallen everywhere and canals and rivers are full. Some injury has been done by excessive moisture to the crops on low-lying lands, and before the last rainfall rust (*kungi*) was showing itself in places. The late favourable rains followed by sunshine have, however, cleared it away. Sunshine is what is wanted now. Prices are ruling unusually low throughout the Province.

FRED. A. ROBERTSON,
Director of Land Records and Agriculture, Punjab.

Even, however, if the whole of India be taken, the actual yield scarcely reaches the same proportion. In 1892 it was 60,775,245 bushels for the United Kingdom, and 206,640,000 for India. In the United Kingdom, however, the yield per acre is greater than that of any other country in the world. In 1892 it was 26·48 bushels per acre (it rose as high as 31·30 in 1891), while in India it was only 8·44 bushels in 1892, and 9·66 in 1891; or roughly, only about a third of the yield per acre in the United Kingdom.

Canaigre.—The new tanning material known as Canaigre, obtained from the root of *Rumex hymenosepalum*, has been fully described in the *Kew Bulletin* [1890, pp. 63–69], The plant is found widely distributed in sandy soils on both sides of the Rio Grande and northward over a large portion of Western Texas and New Mexico. According to Professor Collingwood, quoted in the *Pharmaceutical Journal*, (XXIII. [3] p. 886), "the yield of Canaigre root in poor soil is about "seven tons per acre, whilst when properly cultivated as much as

" 20 tons per acre may be obtained. The green root has yielded " 11·46 per cent. of tanning, and the dry material 31·62 per cent. A " peculiar feature of the roots is that they contain 18 to 20 per cent. " of starch which necessarily causes some difficulty in working." A detailed account of Canaigre tannin is reproduced in the *Pharmaceutical Journal* (XXIV. [3], pp. 42–45) from the *American Journal of Pharmacy* of April 1893. The latest information is contained in a Foreign Office Report (No. 1336, Annual Series, 1894), furnished by Mr. Horace D. Nugent, Her Majesty's Consul at Galveston (pp. 17–18).

"Canaigre is a tanning agent. It is a species of sour dock, and the dried root contains about 33⅓ per cent. of tannic acid, or a higher average than the very best oak bark. It grows wild on most of the New Mexican plains or 'mesas,' and in that state yields from one ton to four tons to the acre, and in rare instances, five tons. Under very simple cultivation and scanty irrigation the yield is at least 10 tons per acre, and it will average 10 tons to 20 tons. The United States experiment station attached to the Agricultural College at La Cruces has two fields planted now, one irrigated, the other dry. The habits and evolution of this plant from the wild to the cultivated state are being closely watched and recorded. At Deming, extracting works have been erected, and the product is being shipped to several tanneries in the United States and England."

Artificial production of Mushroom Spawn.—In an interesting pamphlet, entitled *Sur un noveau procédé de culture du Champignon de couche*, MM. J. Costantin and L. Matruchot describe a method, first published by them in the *Comptes rendus*, for July 3, 1893, by which the spawn of the edible mushroom can be produced in a state of purity wholesale. The pure spores are collected and sown in a special sterilised nutrient solution, where they germinate and form a pure white mycelium arranged in strands. This mycelium is placed on sterilised dung, where it grows abundantly for some weeks. At this stage it has the appearance and odour characteristic of natural spawn, and when placed in a mushroom-bed grows and produces mushrooms normally.

I. *The production of a Pure Spawn or Mycelium.*—At present cultivated mushrooms are subject to several diseases, the germs of which are introduced along with the spawn.

II. *Choice of Varieties.*—Certain varieties, especially the one having the cap entirely white, are most esteemed in the market. By the method described, it is practicable to perpetuate any desired variety in a pure state, a condition not possible by any other means.

III. *Permanent production of Spawn.*—At present the production of spawn is intermittent; by the culture process spawn can be produced throughout the year, which is an obvious advantage.

The authorities hope to apply the same method to the cultivation of other edible species, as the Boletus and Morel.

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 90.] JUNE. [1894.

CCCLXXXVI.—TREATMENT OF DISEASED SUGAR-CANES IN THE WEST INDIES.

In consequence of the appearance of disease affecting sugar-canes in the West Indies, great attention has been devoted to the subject at Kew, and in the course of official correspondence with the Colonial Office, and with local authorities in the islands concerned, various recommendations have been made with the view of enabling the sugar-planters to deal effectively with it.*

Fungoid Disease.

The diseases chiefly engaging attention at the present time are the rind-fungus (*Trichosphæria sacchari*), and the root-fungus (*Colletotrichum falcatum*). It is possible that these may eventually prove to be different forms of one and the same species, but the investigations on this point have not yet been completed.

There is apparently a danger that attention is being diverted in the West Indies over too wide a field, and that the few, but really destructive enemies of the sugar-cane, are likely to be overlooked. The recommendations made from Kew have, therefore, been confined to certain well-established facts, and to precautions and treatment calculated to improve the industry generally. For instance, it has been sought to impress upon those engaged in sugar growing, in the first place, to select only the best and strongest canes for planting purposes. This is a matter so obvious that it would hardly seem necessary to mention it. There is, however, sufficient evidence to show that, following the routine practice of a bygone age, cane-tops for planting are too often taken from weak and worn-out canes, and even from those which are actually diseased. When this is done disease in the cane-fields is inevitable. Not only so, but the disease every year takes stronger hold of the cane-fields until at last the cultivation threatens to become unproductive.

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* The following articles have lately appeared in the *Kew Bulletin* on the subject of sugar-cane disease: Sugar-cane disease (*Trichosphæria sacchari*), 1893, p. 149; Root disease of sugar-cane (*Colletotrichum falcatum*, Went.), 1893, p. 345; Gumming of sugar-cane, 1894, p. 1; Sugar-cane disease in the Old World, 1894, p. 81; Sugar-cane disease (continuation), 1894, p. 154.

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Another point dwelt upon is that the diseased canes, directly they show themselves, should be cut out in the fields and burnt. This precaution would prevent the spread of the disease during the season of growth, and allow the healthy canes to fully mature before they are cut. Lastly, it has been recommended that after the canes are cut and the crop is over, the stubble and refuse left on the fields should be burnt. This would tend to cleanse and purify the land by destroying the spores, and afford hope for more immunity from disease for the next year's crop.

These, briefly stated, are the general measures which, if steadily and carefully pursued, must gradually stamp out the disease in all the islands. It will be noticed that they require no special appliances or material; they can be carried out by each planter without considerable expense and with no technical skill or knowledge necessary beyond what is possessed by every sugar planter in the West Indies.

So far, however, although the mischief effected by disease is already serious, the action taken locally has not been at all commensurate with the gravity of the situation. Valuable time has been lost and the position has been steadily getting worse instead of better.

It is all the more noticeable to find that in the Island of St. Vincent definite action has at last been taken, and a committee appointed to inquire into the disease of sugar canes in the island has presented a Report which it is hoped will stimulate action in the other islands. A copy of the St. Vincent Report has been communicated to Kew by the Secretary of State for the Colonies. It embodies the views of experienced planters on the spot and it appears to be drawn up with excellent judgment and foresight. If the recommendations of this Report could be vigorously carried out on all the sugar estates in St. Vincent the results in a few years would not fail to be most beneficial. In order to give as much prominence as possible to the recommendations contained in it the Report is reproduced.

REPORT of the COMMITTEE appointed to Inquire into the Disease of the Sugar-canes in the Island of St. Vincent.

1. The committee appointed at a meeting held at the "Planters' Club" on the 13th instant met on the 21st and 28th instant, and after full discussion and careful consideration passed the following resolutions:—

(1.) That in the case of pieces or cane-fields not to be ratooned,

(*a.*) All stools should be stumped out and then the pieces within fourteen days be burnt; (*b.*) Immediately after the burning all unburnt or partially burnt stools, canes, tops, bush, rubbish or other vegetable matter should be most carefully collected, placed in heaps, and burnt to ashes.

(2.) That in the case of pieces to be ratooned,

(*a.*) The pieces should without exception be thoroughly burnt off within 14 *days at the utmost* after cutting; (*b.*) Immediately after the burning all unburnt or partially burnt canes, tops, bush, rubbish, or other vegetable matter should be most carefully collected, placed in heaps, and burnt; and (*c.*) After the stools have sprouted and subsequent to measures (*a.*) and (*b.*) young canes showing the slightest weakness or indication of disease be without fail cut out from the base of the sprouts and burnt.

(3.) That in the case of plant canes,

(a.) That the plants be taken from fields unaffected by any disease, and the greatest care be observed to most scrupulously examine the plants themselves and to throw out all but the strongest and healthiest looking; (b.) The plants selected for planting be stripped and soaked in a strong solution of temper lime and water or other mixture known to be fatal to the fungus or borer; and (c.) After the plants have sprouted every sprout or young canes showing the slightest weakness or indication of disease be without fail pulled up and burnt.

(4.) That in the case of all supplies, whether for plants or ratoons, the same course be pursued as recommended in resolution (3). All dead plants taken out when supplying, be burnt outside the piece.

(5.) That immediately after burning the banks should be broken and manure or green dressing be put on them.

2. As regards resolution (2) (a) the maximum limit of 14 days has been recommended in order to leave it to the discretion of planters to burn within a day or two after the cutting of the piece or to delay the operation until after the stools have sprouted, *not later than* 14 *days after cutting* to suit the nature of the soil and the opinion of the individual planter.

3. The members of the committee, whilst hitherto more or less fully convinced of the absolute necessity of some such course, have now become positive as to the dire necessity for carrying out immediately the measures recommended, or others as experience may hereafter prove as more efficacious, with intelligence, energy, perseverance and above all unity of purpose, as they find that precisely the same measures were enforced by legislative enactment by the Government of Mauritius some 20 years ago, as the only possible means of freeing their agriculture, within a few years, of an insect (the borer) which threatened it with certain ruin, and also from the terms of the letter from Mr. W. Thiselton Dyer so recently as March this year, forwarded to the Governor of the Windward Islands by the Secretary of State in a despatch dated 24th ultimo, on the subject of the fungus in Barbados.

4. The Committee therefore, as the only means of securing universal and combined action throughout the Colony, urge in the most pressing manner on all proprietors of estates and on all and any persons having or growing canes the necessity for carrying out the measures above referred to and, in the event of their not being carried out, suggest that the Government be asked to legislate so as to render these measures obligatory later on.

Moved by Mr. Campbell and seconded by Mr. H. A. Hazell that the foregoing resolutions be adopted and submitted to the President of the Planters' Club and the Chairman of the meeting, the Honourable C. J. Simmons, with a request that they be printed and circulated without delay to all proprietors and cane-growers, urging on them the desirability of instructing the managers and others to take the necessary prompt action, and that a copy of the resolutions be inserted in the local paper and a copy sent to His Excellency the Governor-in-Chief, and to His Honour the Administrator with a request that he will cause the same to be published in the next issue of the "Government Gazette."

(Signed) J. G. COULL,
Chairman.

28th April 1894.

INSECT PESTS.

One of the most striking features of the reports that reach Kew is the prominence still given to the injuries caused to sugar-canes by the moth-borer (*Chilo saccharalis*) (figured in the *Kew Bulletin*, 1892, p. 153). This was first described by the Rev. L. Guilding from St. Vincent specimens in 1828. There is little doubt that it has been present in the West Indies for the last hundred years. It is now probably found in every part of the world where the sugar-cane is cultivated. The other insect pest is the shot-borer (*Xyleborus perforans*) fully described with figures in the *Kew Bulletin* 1892, pp. 153–178.

The loss sustained owing to the attacks of these insects must be very large, and yet there is apparently little or nothing being done to lessen it.

In a letter received from Mr. Henry Powell, Curator of the Botanic Station at St. Vincent, dated the 23rd November last, he describes a visit paid to several sugar estates at the invitation of the proprietors to examine the canes. In one instance he states: "During our interview "about half-a-dozen canes were brought in for our inspection, one of "which was riddled by the moth-borer." In a field of canes lately stripped "the presence of the moth-borer, which had not been observed "before, was disclosed in considerable numbers." Its presence in nearly mature canes "can readily be detected by the yellow tops, showing the "canes to be injured beyond recovery." In riding through another estate, "the presence of the moth-borer was seen on all sides, but on "two fields the borer and other pests had become thoroughly "established." In another instance: "the canes were most luxuriant, "but already the moth-borer was playing great havoc amongst them "and was steadily on the increase."

In the Leeward Islands the moth-borer appears to be equally rife. Mr. C. A. Barber, F.L.S., Superintendent of Agriculture, as lately as the 16th April last, reported to his Government: "The fungus (*Trichosphæria*) is our greatest enemy." Mr. Barber places the "destruction of the moth-borer" as the first duty of the planter. He goes on to state, "It is almost impossible to obtain a cane of any variety "unaffected by the moth-borer . . . each moth I have captured has "laid 50 to 150 eggs, and in one lot I hatched 97 per cent. of the "grubs. From this it will be seen that the supply is practically unlimited. I have observed as many as 12 in my own drawing-room "in a couple of hours, although there is no cane field immediately to "windward."

A valuable summary of information respecting the moth-borer is given in *Indian Museum Notes*, Vol. I., pp. 22–27, pl. ii. The means hitherto adopted to get rid of it are given in the following extract:—

"A large number of remedies has been proposed for the pest, and it seems to be pretty well established that it can be to a great extent controlled by the burning or burying all the discarded tops, and clearing the fields of all waste sugar-cane stalks after the crop has been taken; for, as the insect passes the winter as a larva inside the sugar-cane, if these are destroyed, there are no moths in the spring to lay the eggs which produce the next year's 'borers.' The waste tops, however, should be carefully gathered together and removed from the field before being burnt, for if they are burnt carelessly, on the field itself, many predaceous insects will be liable to be destroyed, which take shelter in the ground and assist in reducing the numbers of the pest.

"The following may be noticed among the remedies that have been suggested:—

"Guilding recommends* that all the dry and useless leaves, under which, he says, the moth lays its eggs, should be stripped off; he claims that this treatment has been found effective in removing the pest.

"Porter quotes,† the practice of "introducing a pinch of quicklime into the heart of the young cane" for the destruction of the pest.

"Westwood notices‡ that in Jamaica in 1841, the ravages of the borer were to a great extent checked by allowing the refuse to accumulate upon the grounds, and burning them there, the old roots subsequently throwing up more vigorous shoots.

"Miss Ormerod,§ in writing of the pest in British Guiana about the year 1879, quotes the practice of cutting back the cane below the surface of the ground, covering the plant with mould, and adding a handful of lime. The cutting out of the affected canes was tried on one estate over 246 acres, the result being considered satisfactory. In this case the canes cut out were put through the mill and sufficient rum and megus obtained from them to pay expenses. Miss Ormerod also quotes the practice of steeping the cane for 48 hours in water before planting it, a treatment which was thought, on one plantation where it was tried, to destroy the hibernating larvæ without injury to the cane. It appears from the inquiries instituted in British Guiana, that it is a mistake to burn the refuse sugar-cane on the fields themselves, as this destroys the ants, which, when unmolested, rendered valuable assistance in keeping down the pest. The plan therefore approved was to burn the refuse cane, after collecting it in heaps, outside the fields.

"Dr. Riley recommends‖ burning all "tops" during the winter so as to destroy the larvæ which hibernate in them; selecting seed-cane from the least infested portion of the plantation and laying it down in furrows during the winter, covered with earth as deeply as should be found possible without inducing decay, and only uncovering it as it is wanted in the spring for planting out, thus preventing the egress of moths from the larvæ which have hibernated in the seed-cane.

Roth writes that¶ "he has kept the pest under control in Queensland "by sending boys with sharp pocket knives along the rows of cane. "The boys spotted the dead or dying shoots and cut them off as close "as possible to the parent cutting. They then opened the shoot and "destroyed the fat grub. In some cases, however, the grub had "migrated to a fresh shoot which as yet did not show any sign of "decay, and thus escaped." Roth adds that "while dirty fields were "being destroyed wholesale by the grub clean fields were not infected "to any such extent."

A very striking instance in which the moth-borer (or a very closely allied species) was successfully dealt with came under the notice of Kew from the island of Teneriffe.

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* Trans. Soc. Arts, Vol. XLVI., p. 43 (1828).

† "Nature and Properties of Sugar-cane," by G. R. Porter. London, 1830.

‡ *Gardeners' Chronicle*, 5th July 1856, p. 453.

§ Proc. Ent. Soc. Lond. 1880, p. 16; and 1879, pp. 33 and 36.

‖ In his Report on the insect.

¶ In his "Animal Parasites of the Sugar-cane," p. 12, 1885.

In the south-western corner of this island a very large sugar estate has been established and is now under the management of Mr. Richard Tonge of the Icod and Dauté Estate Company. On this estate the canes were very severely attacked by moth-borer, which was believed also to attack the maize crops of the island. The injuries to the sugar-canes were becoming yearly more and more serious. Mr. Tonge was in despair. He carefully studied the habits of the insects and then organised a system of treatment which was steadily pursued for two years. Every person engaged on the estate was taught to recognise at a glance the successive stages of the insect, viz., the grub, the chrysalis, and the mature insect. A small sum was offered for these and payment was made at the close of each day. During one month (February 1893) there were destroyed 46,884 insects in various stages. During the rest of the year the numbers were not so large, but the record kept of them shows that 9,640 grubs were cut out of standing canes, 5,022 were destroyed in the chrysalis stage, and 1,144 moths were caught on the wing. By judicious management and personal influence Mr. Tonge has so thoroughly enlisted the interest of the workpeople that the moth-borer is becoming less and less plentiful. Its practical extermination on this estate is now only a question of time. The period during which the canes are growing appears to be the most critical time. Women and children are then kept regularly employed in cutting out any canes attacked by the moth-borer, and the grubs are destroyed in their burrows. This is regarded as a most effective plan. It is believed that if this plan alone were regularly pursued in the West Indies for two or three seasons the injuries would be reduced within comparatively small dimensions.

As regards other means for destroying the moth-borer, Mr. Barber, in his letter already cited, has added the following interesting points which deserve consideration. These do not, however, show that the planter should relax his efforts to cut out the grubs in the standing canes. Nothing can do away with the necessity for this. Mr. Barber's remarks exhibit a careful study of the habits of the insect, and draw particular attention to the need for adopting only such remedies as are suited to local circumstances. Countries situated in the tropics, where there is no winter's rest for the canes, obviously require a different treatment from that found suitable in the southern United States and others where canes are only growing during about seven or eight months in the year. In these respects the remedies suggested in the extract from the *Indian Museum Notes* requires some modification.

Mr. Barber remarked, in his Report to the Government, of April 16th:—

"The question of burning has, I believe, been much obscured by the practice in other sugar-growing countries. In the United States there is a winter, the moth-borer hibernating as a grub in the cane; and the burning of the stubble and all dead canes will probably be of service. In Mauritius the moth-borer is credited with spinning a loose cocoon in the trash, and burning the trash will probably be very effective in destroying it. This is quite sufficient to determine the Mauritius borer as different from ours. I have not at present met with any stage of our borer in the trash; it changes from grub to moth in the burrows in the cane.

"I recommend a study of parasites of the moth-borer. At present a fungus, attacking it in its burrows, does us good service. In one case I detected 13 dead grubs in three Caledonian Queen canes. These were all victims of an undetermined fungus which 'mummifies' the grubs.

I have not at present succeeded in obtaining the ripe spores for trials in inoculation.

"I have evidence that the vast majority of moth-borer eggs are destroyed by a small parasitic fly. Some of the eggs turn yellow and addled; these probably were unfertilised. Others are left transparent and empty; from these the grubs have escaped. The great majority, perhaps *great* because of their conspicuousness, turn black, and when punctured show a much smaller and more regular hole than the minute grub makes. These I regarded as parasitised. I laid the suspected specimens of blackened eggs before Mr. Hubbard, the entomologist in the United States Department of Agriculture, who is now visiting Montserrat, and he at once recognised the presence of a parasite belonging to a well-known class of egg-eaters. When I detailed the numbers of eggs laid by the moth-borer, and the great majority of blackened ones, he remarked, 'Without this fly you could not grow a 'cane in these islands.'"

The following papers are published in continuation of previous correspondence :—

ROYAL GARDENS, KEW, to COLONIAL OFFICE.

Royal Gardens, Kew,
June 5th, 1894.

SIR,

I HAVE the honour to acknowledge the receipt of your letter with enclosures of May 8th and June 2nd on the subject of the disease now affecting the sugar-cane in the West Indies.

2. The history of the matter is briefly this :—

In a letter to the Colonial Office, April 5th, 1893, I pointed out the appearance of the disease in the West Indies, now generally spoken of as "Rind-disease." I stated that it was due to a fungus to which the name *Trichosphæria* had been given; that this fungus possessed different reproductive phases which had been mistaken for distinct fungi; that it was a very destructive parasite which can effect a lodgment on the young leaves of the sugar-cane but not on the old ones; and finally, that no practical remedy can be suggested to check the progress of the disease beyond the "cutting out" and the careful destruction by burning of every diseased cane. In a further letter, of March 12th last, I stated my opinion that the *Trichosphæria* had made its appearance quite recently in the West Indies, and I had little doubt that it had been introduced from the Old World.

In another letter of November 3rd, 1893, I informed the Colonial Office that a further disease, which may be distinguished as "Root-disease," existed in the West Indies; that it was identical with one which existed in Java, where it had been ascertained to be due to a fungus to which the name of *Colletotrichum* had been given. The opinion was expressed that "if perfectly healthy and uninfected canes were only used for "propagation, the disease would not be found to give much trouble." As will be seen from what follows there is positive evidence that at any rate at St. Vincent this precaution is neglected.

3. The specimens of diseased canes obtained by Mr. Bovell in St. Vincent, and referred to in Colonel Sandwith's despatch of May last, have reached Kew, and have been carefully examined. I enclose a copy of the report of the member of our staff to whom I entrusted their examination.

It is evident from these specimens that canes infected with rind-fungus are used for propagation. It further appears that when this was the case the resulting plants are attacked by root-disease. This fact points to the conclusion that the root-disease and the rind-disease are really due to one and the same organism, and that the ***Colletotrichum*** is only another phase of the polymorphic *Trichosphæria*. This was, indeed, suggested by Mr. C. A. Barber, the Superintendent of Agriculture in the Leeward Islands, in a private letter, December 1, 1893, as the result of his observations made by permission of the Secretary of State in Barbados. But the evidence was not deemed at the time conclusive. The possible identity of the two diseases is still a matter under investigation at Kew. But assuming, as seems probable, that it is well founded it obviously very much simplifies the problem.

4. The remaining contents of the papers call for little remark as far as Kew is concerned. I may, however, be permitted to say that it seems to me a matter for regret that they exhibit a greater inclination to discuss the situation than to take prompt action. I see nothing to modify in the demi-official letter of March 19 last, which, at his request, I addressed to the Governor of Barbados.

5. With regard to compensation, I may point out that I had in view the circumstances of Barbados, which is, I understand, virtually dependent on sugar cultivation. My suggestion was not intended to apply to other colonies where that condition does not obtain.

6. I am not prepared to use any further arguments than those I have already adduced on the absolute necessity of destroying diseased canes by burning. If the sugar-planters will not wage war in the only effective way on the enemies of the sugar-cane, they can only have themselves to blame for the consequences. Mr. Barber urges against burning in Antigua that "the whole atmosphere is saturated with the spores." Even if true, this is no argument against attempting to cut off the supply. No pestilence would ever be checked if mankind simply folded its hands in resignation. It is quite evident that in Antigua at any rate no intelligent pains are taken to combat the enemies of the sugar-cane. It is quite certain that the moth-borer can be checked by persistent effort. And as to the shot-borer, I may quote the opinion of Prof. Riley, the well-known entomologist of the United States Department of Agriculture, who, writing to the Trinidad Committee, said :—
"You are perfectly correct in tracing the increase of the shot-borer to
" the discontinuance of the burning of the bagasse (as we call it in this
" country), and it seems probable that the resumption of this custom
" will greatly decrease the number of these beetles."

I may, however, remark that a general conflagration, as assumed by Mr. Barber, is not absolutely necessary. Careful cutting out of diseased canes should go on continually during the growing season. A general burning should only be resorted to in extreme cases.

7. Finally, I must add that there is not the faintest ground for supposing that the disease has in any way emanated from the botanical stations.

I am, &c.
(Signed) W. T. THISELTON-DYER.

Edward Wingfield, Esq., C.B.,
Colonial Office, Downing Street, S.W.

P.S.—Referring again to your letter of June 2, I observe that a definite opinion is requested as to the recommendations of the committee appointed by the Planters' Club in St. Vincent. A careful consideration leads me to the opinion that these are unexceptionable and altogether admirable. They will not merely effect all that is possible against the fungoid diseases, but must also tend to bring the moth-borer under control. It would be extremely desirable that similar steps should be adopted in Antigua and Barbados.

I may add, as an illustration of what can be effected by vigorous and energetic action, that the sugar-industry in the Canaries was menaced by extinction by the moth-borer. Mr. Morris, the assistant director, spent some time in the islands last year, and informs me that by intelligent and energetic action the moth-borer has been completely brought under control in the space of three years.

W. T. T. D.

(Enclosure.)

Root-disease of Sugar-cane, St. Vincent.

The disease is caused by the fungus called *Colletotrichum falcatum*, Went. The mature conidia of this fungus are very abundant in the decayed portions of the canes, hence all such should be burnt to prevent further extension of the disease.

The material forwarded furnishes a clue which may lead to important results in connection with the disease. In one of the "stools" sent the portion of cane used for its propagation is badly infested with *Trichosphæria sacchari*, the fruit of the *Melanconium* stage being abundantly developed. In this same specimen the hyphæ of the *Trichosphæria* can be traced from the old portion into the new canes growing from it. The new canes and their rootlets are attacked by the *Colletotrichum*, which, from the evidence at hand, appears to be nothing more than a condition of the *Trichosphæria*, modified by being more or less buried in the ground. The necessary cultures for the verification or otherwise of this point are now being proceeded with.

G. M.

19th May 1894.

CCCLXXXVII.—THE CITRON IN COMMERCE.

(*Citrus Medica*, Risso.)

The Citron is a member of the orange family, closely allied to the lemon. There are numerous varieties, the most curious being the fingered citron of China and Japan having more or less separate carpels looking very unlike the ordinary elliptical pointed fruit. Specimens of fingered citrons are in the Kew Museums. The citron was the only fruit belonging to the orange tribe known in ancient Rome. The chief use of the citron at the present day is for its rind or peel usually imported into this country in a salted state and afterwards candied for dessert and confectionery purposes. The juice of the fruit is similar to that of the lemon or lime. The essence of citron prepared from the rind when really genuine is a very agreeable perfume. A singular but very interesting use of the fruit of the citron has lately come into prominence.

In a Diplomatic and Consular Report issued by the Foreign Office [Annual Series, No. 1353, 1894], on the trade of Trieste, Mr. Consul Haggard gives an account of the citron trade passing through Trieste. Two kinds of fruit are imported. One is used for preserving and crystallising while the other is used solely in the religious ceremonies of the Jews.

The total import into Trieste in 1893 was about 5,000 tons. Mr. Haggard's account is as follows :—

"The citron trade through Trieste is of great interest, and of some importance. There are two kinds of fruit imported, each intended for very different purposes.

"One is the large fruit used for preserving and crystallising, grown on grafted trees, and gathered from November to January, the other, called the 'Citron for the Law,' is the natural, unripe, and non-edible fruit gathered from ungrafted trees from June to August 15. The latter is solely used in the religious ceremonies of the Jews at the time of the Feast of Tabernacles, and from a commercial point of view it has been perhaps at times the most valuable branch of the citron trade through Trieste.

"It is an enterprise of great antiquity. For centuries past it has been the custom for Jewish merchants from Poland, Russia, and Eastern Europe generally to collect at Trieste about the month of August in each year to await the arrival of the citrons. Until comparatively lately this port has been the sole centre for the distribution of the 'Citrons for the Law.' Political reasons and Jewish disabilities elsewhere probably originally caused it to be especially chosen for the market, but above all the dread of pirates in the Levant prevented the Jews from travelling further south to purchase at the places of production.

"To give some account of the origin of the trade one must first refer to the Bible in Leviticus xxiii., v. 40, where are specified some of the ceremonies to be observed on the first day of the Feast of Tabernacles. In the English Authorised Version the translation appears to be incorrect, and no mention of any 'fruit' to be used at the Feast is made either in Leviticus or the parallel passage in Nehemiah viii., v. 15. This, however, is corrected in the Revised Version as far as Leviticus is concerned, where the words 'fruit of goodly trees' appear, without specifying, however, what kind of fruit should be employed. The Hebrew Version as commonly used is equally inexplicit, but singularly enough in the Italian Version 'the fruit of citron trees' is mentioned as a special kind to be used at the Feast. I am not aware from what authority this translation was obtained, but it is remarkable that the Italian Bible should mention by name the fruit used for ages by the Jews, who themselves attribute the selection of that of the ungrafted citron tree simply from its resemblance in shape to the human heart, and from its fine odour."

I here quote the parallel readings :—

Leviticus, Chapter xxiii., Verse 40.			Nehemiah, Chapter viii., Verse 15.
English Authorised Version.	English Revised Version.	Translation of Italian Version.	English Authorised Version.
"And ye shall take you on the first day the boughs of goodly trees, branches of palm trees, and the boughs of thick trees, and willows of the brook, and ye shall rejoice before the Lord your God seven days."	"And ye shall take you on the first day the *fruit* of goodly trees, branches of palm trees, and boughs of thick trees, and willows of the brook, and ye shall rejoice before the Lord your God seven days."	"And on the first day take unto yourselves of the fruit of Citron trees, branches of palms, boughs of myrtles and willows of the river, and rejoice in the Lord your God for seven days."	"And that they should publish and proclaim in all their cities and in Jerusalem, saying, Go forth unto the mount and fetch olive branches, and pine branches, and myrtle branches, and palm branches, and branches of thick trees, to make booths as is written."

"It has ever been held that the fruit must be as unblemished as possible, prices varying enormously in proportion to the entire perfection of the specimens. I have been credibly informed that a single fruit has fetched of late years as much as 3*l.* 10*s.* Even in 1893 some were sold for as much as 1*l.* each.

"It is absolutely necessary that the calyx should be present and uninjured, and for this reason (because at the time of the Feast the fruit is not mature) the unripe fruit is gathered. The importance of this point lies in the fact that the presence of the calyx is supposed to denote extreme freshness, implying the fiction that the buyer (perhaps in Poland) has himself plucked the citron from its branch in the Holy Land.

"It is said that through Jews becoming gradually less orthodox in the East of Europe the demand for 'Citrons for the Law' is likely to decline, but facts point to no such probability at present, on the contrary it would pay to plant further, as prices are even now so high ; and the attention of British enterprise, in Cyprus especially, is called to this, bearing in mind always that the Jewish requirements must be most strictly complied with to make such an undertaking successful.

"The Jewish merchants arriving here from the East of Europe to purchase the citrons are often men of considerable wealth, but their appearance belies it. Although large numbers of them may have collected in Trieste, they are only seen about the streets occasionally in ones and twos. The object of this self effacement is to convey the impression that there are very few of them in the town competing, and so prevent a rise in prices.

"Although the only dialect they are acquainted with, as a rule, is Yiddish, their reputation for success and sharpness is remarkable, but as the trade is almost entirely in the hands of the Jews, there is not much Christian complaint against them.

"The 'Citrons for the Law' ('Cedri della Legge'), that is, the immature fruit of the ungrafted tree, are chiefly grown in the Ionian Islands, Parga, Jaffa, and the Holy Land.

"There is no prejudice nowadays in favour of those from the Holy Land, although it appears to have once existed.

"Until lately the fruit most in demand has been that exported from Corfu, in consequence of its superiority in growth. But two circumstances have tended to check the Greek's practical monopoly; first, in consequence of combination, the high prices they asked; and, second, the riots against the Jews at Corfu in February 1891, for which the Polish and Russian Rabbis have retaliated by boycotting citrons from that quarter, pronouncing an anathema against all fruit from the Ionian Islands.

"From the customary restrictions imposed by the Rabbis upon the trade as given below, this measure has had most weighty consequences; they have avenged the wrongs of their race, and will eventually lower prices by one and the same manœuvre. All fruit for use at the Feast of Tabernacles, no matter whence shipped, must bear inside each case a certificate of origin signed by the Rabbi at the port of shipment. This will show with what ease the Jews can entirely control the citron trade from any quarter.

"In consequence of the temporary suppression of this Ionian Islands trade in 'Citrons for the Law' (except with forged Rabbi's certificates), the cultivation of the tree is already commencing elsewhere, notably amongst the agricultural Jews' colonies recently settled in the Holy Land upon emigration from Russia, and Russian and Polish Jew merchants are, for the first time, now beginning to travel to these places of production to purchase off the trees. Doubtless they would do the same to Cyprus, or elsewhere, if there was fruit to be bought. A rival market at Odessa is also now springing into existence, and through it a small quantity of 'Citrons for the Law' is finding its way into Eastern Europe.

"The packing of the fruit, no matter where shipped, is conducted with the greatest pains, and after most careful selection. Each case contains 120 citrons, and each citron is wrapped round with very soft tow, every possible measure being taken to prevent the fruit from being bruised, and above all its calyx from being injured. Prices varied this year at Trieste from 3 fl. to 10 fl. for each citron, but especially fine and perfect specimens reached 12 fl., or about 1*l.*

"In consequence of the prohibition by the Rabbis of the Ionian Islands citrons, there has, of late years, been an enormous falling of in supply. Probably over 50,000 'Citrons for the Law,' with the calyx attached, were sold in Trieste in 1893, but even this number represents a large sum of money changing hands for that one kind only.

"A small quantity, 1,500 or 2,000 'Citrons for the Law,' with the calyx, find their way to England annually.

"It is not, however, absolutely necessary that the 'Citron for the Law' should have the calyx, if from its peculiar variety it naturally has none that remains, but it must have been gathered from an ungrafted tree. Prejudice, however, is strongly in favour of those with the calyx, which bear the same ratio to those without as gold to silver gilt. Citrons without the calyx are imported for the Feast in considerable quantities from Bordighera in Italy, especially since the riots in Corfu.

"It is difficult to separate the quantities of citrons imported by the Jews for their Feast from those for ordinary consumption, but the whole amount of citrons arriving at the Trieste market appears to have been about 5,000 tons in 1893, almost all of which were again exported to England, Germany, and the East of Europe for various purposes. None are exported to America. Quotations have been asked from Chicago, but no business resulted.

"The anathema denunciated against Ionian Islands citrons by the Rabbis of Poland and Russia has, however, it is stated, been, or is about to be, withdrawn."

A trade in citrons, both for preserving as well as for Jewish ceremonies, exists also at Mogador, in Morocco. In a report by Mr. Consul Payton for the year 1883 [Foreign Office, Commercial, No. 4 (1884), pp. 511–512], interesting particulars are given of the locality whence the "holy" citrons are obtained. This appears to be the province of Soos, on or near the banks of the Great Soos River. Mr. Payton's account is as follows:—

"Citrons, nearly all of which go to Great Britain, amounted to 325*l*., or 67*l*. more than in the previous year. Of the above amount about half may represent the value of the ordinary citron of commerce—a very large and thick-rinded fruit, which, generally sent home in brine, is ultimately converted into 'candied peel.' But the remaining portion of the sum represents the relatively much higher value of a very curious, apparently rare, and highly-esteemed fruit, which, though sold here at so high a rate as an average of about 32*s*. per 100, or nearly 4*d*. for each fruit, appears never to be eaten.

"This may be spoken of as the sacred or holy citron of the Jews, which is carried to their synagogues during the Feast of the Tabernacles, it having an emblematical significance. So highly prized is this fruit by the faithful observers of Israelitish tradition, that specimens without blemish sometimes fetch as much as 4*s*. each here, while in England, I am informed on good authority, they are sold at certain synagogues for the extraordinary price of 1*l*. 1*s*. to 2*l*. 2*s*. each. Their use is supposed to be derived from injunctions contained in the 23rd chapter of the Book of Leviticus: 'And ye shall take you on the first day the boughs '(Hebrew version, *fruit*) of goodly trees, branches of palm-trees, and ' willows of the brook.'

"But the Jewish version of the same passage reads: 'And you shall ' take to yourselves on the first day the fruit of the tree *Hadar*, palm- ' leaves, boughs of the tree *Aboth*, and willows of the brook.' These special fruits, boughs, &c., are described in a Jewish book, entitled, 'The Festivals of the Lord,' as 'fruit of the tree *Hadar*, or "citron" ' (Hebrew, *troon*); the "capoth temarim" or palm-leaves, boughs of the tree *aboth*, or "myrtle," and brook willows.'

"The 'troon' or 'Tabernacle citron,' as it is sometimes called, is a fruit rather larger than a lemon, pale, yellowish-green in colour (being always plucked before it is fully ripe), and said to contain only one pip, and to be of a very pure nature, and to keep sound for a very long period. Those which are despatched hence are carefully packed in cotton-wool or other soft material, as the price which they will realise for their holy use is entirely dependent on the greater or less freedom from blemish which the priests can certify concerning each specimen.

"Inquiry as to the exact locality of their production has resulted in fixing it at a place called Assats (sometimes Assat), which is in the province of Soos, at no great distance (some say half a day, some a day) from the town of Tarudant, and on or near the bank of the great Soos river. It is stated, with regard to this interesting place, that there is a very ancient Hebrew graveyard there, and orchards known by the names of Moses, Aaron, David, &c., also that the authority of the Moorish Government is not respected there.

"Jewish informants here have said that these 'troons' come from no other place but Assats; but they have been unable to explain how the faithful in many far distant parts of the world manage to provide themselves with these necessary emblems—the shipment of which from Mogador in 1883 amounted to 110 boxes, containing 9,024 specimens of this interesting vegetable production."

In a subsequent report [Foreign Office, Annual Series, 1891, No. 874], Mr. Payton adds statistics showing that the value of citrons shipped from Mogador in 1890 was 592*l.*

CCCLXXXVIII.—NEW ORCHIDS: DECADE 9.*

81. **Dendrobium Hildebrandii**, *Rolfe*; pseudobulbis elongatis robustis subteretibus demum sulcatis, foliis elliptico-oblongis obtusis v. inæqualiter bidentatis coriaceis decidius, racemis axillaribus suberectis 3–4-floris basi vaginis tubulosis tectis, bracteis ovato-oblongis obtusis concavis, sepalis oblongo-lanceolatis apiculatis subtortilibus, petalis elliptico-oblongis obtusis v. apiculatis subtortilibus, labello brevissime unguiculato limbo suborbiculari obtuso, disco velutino, columna brevissima, mento conico obtuso brevi.

HAB.—Shan States 1,500 ft. alt.; *H. H. Hildebrand.*

Pseudobulbi 1½–2 ped. alti. *Folia* 4–5 poll. longa, 1¼–1¾ poll. lata. *Racemi* 2–3½ poll. longi. *Bracteæ* 3 lin. longæ. *Pedicelli* 1¼–1½ poll. longi. *Sepala* 16–18 lin. longa, 4 lin. lata. *Petala* 6 lin. lata. *Labellum* 16 lin. longum, 15 lin. latum. *Columna* 2 lin. longa. *Mentum* 3½ lin. longum.

A handsome species collected in the Shan States by H. H. Hildebrand, Esq., in April 1893, and sent to Messrs. Hugh Low & Co., of Clapton, together with living plants, which flowered in their establishment a year later. It has the general habit of a strong *D. signatum*, Rchb. f., to which it is perhaps most allied. The sepals and petals are somewhat twisted as in *D. tortile*, Lindl., though their shape and colour are quite different. The sepals and petals are very light whitish yellow, and the lip deep orange-buff with a broad light yellow margin. Mr. Hildebrand collected three different forms; one with sepals and petals pale green and lip sulphur yellow, one with sepals and petals creamy pink and the lip yellow, and a third like the last, with the addition of two dark chocolate blotches in the throat. He observes that it grows in magnificent huge masses, and on one of the plants he counted upwards of 1,500 blooms. The old pseudobulbs show it to be as floriferous as *D. nobile*, Lindl.

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* *Phaius roseus*, Rolfe, described at p. 4 of the last volume as doubtfully a native of West tropical Africa, is now known to be from Lower Burma, where it has been collected by Mr. Boxall.

82. **Dendrobium hamatum,** *Rolfe;* pseudobulbis elongatis gracilibus cylindraceis, foliis oblongis apice oblique acuminatis, racemis axillaribus pendulis multifloris, bracteis oblongo-lanceolatis acutis, floribus mediocribus, sepalis triangulo-ovatis obtusis v. apiculatis supra medium concavis lateralibus in mentum elongatum arcuato-hamatum productis, petalis late elliptico-oblongis obtusis, labello unguiculato pandurato lobis lateralibus brevibus truncatis paullo concavis intermedio suborbiculari crispo-undulato, disco lævi basi in callum brevem caniculatum producto, columna brevissima.

HAB.—Cochinchina.

Pseudobulbi 1½–2¼ poll. longi. *Folia* 4–5 poll. longa, 1–1¼ poll. lata. *Racemi* 3–4 poll. longi. *Bracteæ* 2–3 lin. longæ. *Pedicelli* 9 lin. longi. *Sepala* 8–9 lin. longa, 4 lin. lata. *Petala* 7–8 lin. longa, 4½ lin. lata. *Labellum* 8 lin. longum, 5 lin. latum. *Mentum* 1 poll. longum.

This is a very distinct species which flowered in the establishment of M. Alexandre Regnier, of Fontenay-sous-bois, Seine, France, in April last, having been introduced by him from Cochinchina. It belongs to the section *Pedilonum*, but, so far as can be ascertained, is very different from any described species. The sepals and petals are very light whitish yellow, with several broad stripes composed of innumerable purple dots more or less suffused together. The pandurate lip is light yellow with a faint purple stain on the middle of the front lobe. The callus of the lip is peculiar, being a kind of boat-like extension of the conduplicate sides of the unguis, and is stained with purple in the cavity. The name is given in allusion to the shape of the mentum.

83. **Eria cinnabarina,** *Rolfe;* pseudobulbis ovoideis subcompressis di-triphyllis, foliis oblongo-linearibus obtusis v. subacutis terminalibus, racemis subterminalibus circa 6–floris, bracteis lanceolato-oblongis subacutis, sepalis lineari-lanceolatis subobtusis lateralibus in mentum conicum productis, petalis subconformibus, labello trilobo lobis lateralibus semioblongis obtusis intermedio elliptico-oblongo obtuso, disco basi tricarinato carinis integris lateralibus majoribus, apice quinquecarinato carinis crenulatis, columna brevi.

HAB.—Borneo.

Pseudobulbi 1–1¼ poll. longi. *Folia* 5–6½ poll. longa, 6–8 lin. lata. *Racemi* 3–4 poll. longi. *Bracteæ* 5–9 lin. longæ. *Pedicelli* ¾–1 poll. longi. *Sepala* 7–8 lin. longa, 1½ lin. lata. *Petala* 6–7 lin. longa. *Labellum* 7 lin. longum, 3 lin. latum. *Columna* 2 lin. longa. *Mentum* ? lin. longum.

A very distinct species introduced by Messrs. Linden, L'Horticulture Internationale, Brussels, with whom it flowered in April last. It belongs to the section *Hymenaria*, and its affinity is with *E. myristiciformis*, Hook. f., and *E. bractescens*, Lindl. The flowers, as well as the whole raceme, rachis, bracts, and pedicels, are of a deep cinnabar-orange colour, which, so far as can be ascertained, is not found in any other described species of this section of the genus.

84. **Cœlogyne swaniana,** *Rolfe;* pseudobulbis elongato-lanceolatis tetragonis diphyllis, foliis elliptico-lanceolatis breviter acuminatis undulatis basi attenuatis, racemis pendulis elongatis gracilibus multifloris rachi fusco-puberulo, bracteis concavis latissime ovato-oblongis acutis, sepalis oblongo-lanceolatis subacutis carinatis, petalis linearibus acutis, rabello trilobo lobis lateralibus erectis obtusis margine columnæ appressis

intermedio reflexo triangulo-ovato subacuto, disco tricarinato apice quinquecarinato carinis crenulatis basi trilamellatis fimbriatis, columna clavata arcuata alata.

HAB.—Philippines.

Pseudobulbi 2–3½ poll. longi, ½ poll. lati. *Folia* 4–8 poll. longa, 1½–2 poll. lata. *Racemi* ¾–1 ped. longi. *Bracteæ* 5–6 lin. longæ. *Pedicelli* 1 poll. longi. *Sepala* 14 lin. longa, 4 lin. lata. *Petala* 14 lin. longa, 1½ lin. lata. *Labellum* 10 lin. longum. *Columna* 9 lin. longa.

This is allied to the Bornean *C. dayana*, Rchb. f., to which it bears a general resemblance, though the pseudobulbs, leaves, and racemes are all shorter. The side lobes of the lip are also not reflexed at the tip, the front lobe smaller and narrower, the keels much less strongly crested, and, lastly, the present species has the three keels produced at the base into three erect fimbriate plates, which are absent in *C. dayana*. The sepals and petals are white, and the lip brown, veined with yellowish-white, except the area between the keels, which is of the latter colour. It was introduced by Messrs. F. Sander & Co., of St. Albans, and flowered in their establishment in April last.

85. **Epidendrum Ellisii**, *Rolfe;* caulibus erectis elongatis teretibus distichophyllis, foliis oblongis obtusis carnosis, racemo terminali multifloro, bracteis triangulis v. subulato-triangulis acutis v. acuminatis, pedicellis elongatis, sepalis oblongo-lanceolatis acutis postico apice recurvo lateralibus apice subobliquis, petalis lanceolatis acutis, labello trilobo lobis lateralibus rotundato-auriculiformibus inciso-dentatis intermedio cuneato-obovato truncato apiculato denticulato v. subintegro, callo carnoso ovato apiculato crenato, clinandrio apice fimbriato.

HAB.—Columbia.

Pseudobulbi 1–1½ ped. longi. *Folia* 3–4 poll. longa, 1 poll. lata. *Racemi* 2–4 poll. longi. *Bracteæ* 2–3 lin. longæ. *Pedicelli* 1½ poll. longi. *Sepala* 7–8 lin. longa, 2–2½ lin. lata. *Petala* paullo minora. *Labellum* 7–8 lin. longum, lobis 2–3 lin. latis.

This is a very handsome species which flowered in the collection of Welbore S. Ellis, Esq., Hazelbourne, Dorking, in April last, and was awarded a First-class Certificate by the Royal Horticultural Society. It belongs to the section called by Lindley *Amphiglottium Schistochila tuberculata*, but cannot be identified with any of the described species. In the shape of the lip it approaches *E. Lindeni*, Lindl., though the two are quite distinct in other respects. The sepals and petals, together with the pedicels and column, are carmine-rose, the lobes of the lip pale lilac-rose, and the crest yellowish white, with some orange-yellow in the cavity in front of the clinandrium.

86. **Bifrenaria Charlesworthii**, *Rolfe;* pseudobulbis tetragono-ovoideis subcompressis monophyllis, foliis oblanceolato-oblongis subacutis v. obtusis basi in petiolum brevem attenuatis, scapis erectis 5–6-floris, bracteis oblongis obtusis, sepalis elliptico-oblongis subacutis v. apiculatis lateralibus in mentum conicum productis, petalis lineari-oblongis subacutis incurvis parallelis margine revolutis, labello graciliter unguiculato limbo suborbiculari subintegro piloso lobis lateralibus erectis subconcavis intermedio recurvo obtuso undulato, callo carnoso erecto emarginato in medio disci, columna brevi clavata, angulis ciliatis.

HAB.—Brazil, prov. Minas Geraes.

Pseudobulbi 1¼–1½ poll. longi. *Folia* 6–9 poll. longa, 1–1½ poll. lata. *Scapus* 6 poll. longus. *Bracteæ* 3 lin. longæ. *Pedicelli* 9–10 lin. longi. *Sepala* 8 lin. longa, 5 lin. lata. *Petala* 6 lin. longa. *Labellum* 5 lin. longum, 6 lin. latum. *Columna* 3 lin. longa. *Mentum* 4 lin. longum.

This species is allied to *Bifrenaria racemosa*, Lindl., and *B. clavigera*, Rchb. f., the former differing in having a smooth lip, while the latter, according to the description, has that organ acute, and the mentum short and inflated, characters which do not apply to the present species. It was introduced by Messrs. Charlesworth, Shuttleworth, & Co., of Heaton, Bradford, with whom it flowered in August 1893. A plant from the same source also flowered in the Kew collection in April last. The sepals and petals are greenish-yellow with a very slight suffusion of light brown, and the lip whitish-yellow spotted with red-brown on the disc, and veined with the same colour on the margin of the side lobes. The crest is deep yellow, and the column white.

87. **Camaridium lawrenceanum**, *Rolfe*; caulibus strictis erectis distichophyllis, pseudobulbis distantibus elliptico-oblongis compressis apice diphyllis, foliis linearibus obtusis, pedunculis axillaribus unifloris basi vaginatis, bracteis lanceolatis acuminatis, sepalis patentibus oblongis subobtusis lateralibus basi in mentum brevem obtusum productis, petalis subconniventibus oblongis subobtusis apice reflexis, labello subintegro obtuso lateribus erectis, disco carnoso unilamellato, columna clavata arcuata.

HAB.—Not recorded.

Pseudobulbi 9–10 lin. longi. *Folia* ½–3 poll. longa, 1½–2½ lin. lata. *Pedunculi* 1 poll. longi. *Bracteæ* 5–6 lin. longæ. *Sepala* 5 lin. longa, 2½ lin. lata. *Petala* 4½ lin. longa, 2 lin. lata. *Labellum* 4 lin. longum, 2½ lin. latum. *Columna* 3 lin. longa. *Mentum* 2 lin. longum.

A pretty little species allied to *C. purpuratum*, Lindl., to which it bears a general resemblance, except for the presence of pseudobulbs. It has flowered in the collection of Sir Trevor Lawrence, Bart., Burford Lodge, Dorking, on two or three occasions, and on March 27th last received a Botanical Certificate from the Royal Horticultural Society. The sepals and petals are yellowish-white, the former spotted with red-purple, most distinctly on the back, and the lip deep dark purple with the apex yellowish-white. The column is also yellowish-white with a purple stigma, and a few red-purple spots at the base of the foot.

88. **Oncidium lucasianum**, *Rolfe*; pseudobulbis ovoideis subcompressis diphyllis, foliis lanceolato-linearibus acutis, scapis brevibus, racemis paucifloris, floribus heteromorphis, bracteis triangulo-ovatis acutis, sepalis unguiculatis obovato-oblongis obtusis carinatis undulatis, lateralibus subliberis v. ad medium connatis, petalis unguiculatis late oblongis obtusis undulatis, labello pandurato, lobis lateralibus parvis obovato-oblongis intermedio orbiculari-reniformi emarginato undulato basi cordato, callo quinquelamellato lamellis verruco-cristatis verruculis circumstantibus, columna brevi, alis semicordato-oblongis crenulatis apice obliquis.

HAB.—Not recorded.

Pseudobulbi 1–2 poll. longi. *Folia* 2–3 poll. longa. *Scapi* 6–8 poll. longi. *Bracteæ* 2 lin. longæ. *Pedicelli* 9–10 lin. longi. *Sepala* 8–9

lin. longa, 3–4 lin. lata. *Petala* 8–9 lin. longa, 5 lin. lata. *Labellum* 9 lin. longum, 10–11 lin. latum. *Columnæ alæ* 2½ lin. longæ.

A bright yellow-flowered *Oncidium* which bloomed with Messrs. F. Sander & Co., St. Albans, in April last, and received an Award of Merit from the Royal Horticultural Society. Its affinities are a little doubtful, but the united lateral sepals and broader petals would technically place it in Lindley's group *Tetrapetala macropetala*, of which it is the first-known species with heteromorphous flowers. In a revision of the genus the character derived from the union of the lateral sepals would certainly have to take a much more subordinate position than Lindley gave to it. One of the flowers received has these organs free, which would suggest another affinity for it, yet a search in other groups has not led to its identification with any described species. If greater importance were assigned to the shape of the rostellum and column wings, most if not all the species with heteromorphous flowers would fall into the enlarged group *Rostratæ*, including the present species.

89. **Saccolabium longicalcaratum**, *Rolfe ;* caule brevi, foliis patentibus oblongis inæqualiter et obtuse bilobis carnosis rigidis, racemis axillaribus multifloris interdum paniculatis, bracteis triangulo-ovatis subacutis parvis, sepalis elliptico-oblongis obtusis, petalis similibus paullo minoribus, labello trilobo lobis lateralibus parvis truncatis concavis intermedio minuto triangulo-ovato subobtuso conduplicato, calcare elongato obtuso subcompresso recto, columna brevissima lata.

Hab.—Burma.

Folia 3–4 poll. longa, 1¼–1½ poll. lata. *Racemi* 3–6 poll. longi. *Bracteæ* 1 lin. longæ. *Pedicelli* 5 lin. longi. *Sepala* 2 lin. longa, 1⅓ lin. lata. *Petala* 1¾ lin. longa. *Labelli calcar* 5–5½ lin. longum. *Columna* 1 lin. longa.

This species was introduced, together with *Cypripedium Charlesworthii*, Rolfe, by Messrs. Charlesworth, Shuttleworth, & Co., of Heaton, Bradford, with whom it flowered in April last. It belongs to the section *Speciosæ* and is allied to *S. compressum*, Lindl., and *S. trichromum*, Rchb. f. It has the general habit of the latter, but is a much smaller plant with a straight spur. The flowers are pale pinkish purple, with a bright purple blotch on either side of the lip close to the minute front lobe. The side lobes are also very small, so that the lip is practically reduced to a straight spur, longer than the pedicels, with the three minute lobes guarding the mouth.

90. **Podochilus longicalcaratus**, *Rolfe ;* caulibus elongatis erectis demum pendulis distichophyllis, foliis numerosis elliptico-oblongis apice reflexis apiculatis, racemis axillaribus numerosis paucifloris vaginis lanceolatis subimbricatis tectis, bracteis lanceolato-ovatis acutis concavis, floribus heterochronicis carnosis, sepalo postico late ovato obtuso valde concavo lateralibus subobliquis ovatis obtusis basi in mentum longum calcariforme arcuatum productis, petalis rhomboideis obtusis, labello longe unguiculato apice trilobo lobis lateralibus rotundatis intermedio late ovato apice tridenticulato, disco bicalloso, columna brevissima.

Hab.—Borneo, on trees at Sarawak, *Lobb.* Philippines, *Cuming.*

Caules 1–2 ped. longi. *Folia* ¾–1¼ poll. longa, 4–7 lin. lata. *Racemi* ¾–1 poll. longi. *Bracteæ* ¾ lin. longæ. *Pedicelli* 2 lin. longi. *Sepala* 1¼ lin. longa. *Petala* 1 lin. longa. *Mentum* 4 lin. longum.

A species with precisely the habit of *P. unciferus*, Hook. f. (Fl. Brit. Ind., VI., p. 81 ; Ic. Pl., t. 2145), and, indeed, confounded with it in both the works cited, though it is constantly different in having the spur-like mentum over three times as long as the rest of the flower instead of only equalling it, as in the Indian plant. It has now been introduced from Borneo by Messrs. Linden, L'Horticulture Internationale, Brussels, who have presented a plant to the Kew collection, where it is flowering profusely. The flowers are semipellucid white, with the petals and lip tipped with rosy purple, and the sepals less distinctly so.

CCCLXXXIX.—COLD STORAGE OF FRUIT.

In a *précis* of pamphlets issued by the Department of Agriculture and Forests in New South Wales, given in the First Report, 1894, just issued, particulars are given (at pp. 6 and 7) of experiments carried out with regard to the cold storage of "deciduous fruit," and the results obtained with each. The experiments lasted from 28th January to 26th August 1893. The fruits experimented upon were as follows :—Apples, pears, plums, peaches, nectarines, grapes, mangoes, pine-apples, tomatoes, and passion fruit. The latter was probably the fruit of *Passiflora edulis.* The result of the experiments are concisely given below :—

A series of experiments in the cold storage of fruit, extending from 28th January to 26th August, 1893, were conducted by the fruit expert (Mr. A. H. Benson) for the Department of Agriculture, at the cold storage rooms attached to the Government meat market, at Darling Harbour, Messrs. Hudson Bros., lessees, having kindly placed a chamber of 50 tons' capacity ships measurement at the disposal of the Department free of all charge.

The system of cold storage employed was one in which an even temperature combined with a constant influx of cold fresh air was maintained, and this system, or rather principle, is the only satisfactory one for use in the case of fruit, as a merely cold air without the necessary ventilation and influx of fresh air has been proved to be insufficient to keep fruit in good condition for any length of time.

The fruits experimented with consisted of the following varieties, viz. :—Apples, pears, plums, peaches, nectarines, grapes, mangoes, pine-apples, tomatoes, and passion fruit, and were obtained from fruit-growers in various parts of the Colony.

Different materials were tried for packing, and the fruit was tested under various conditions, wrapped and unwrapped, in light cases and open well-ventilated cases, and in various states or degrees of ripeness.

The average temperature maintained was 41·74 degrees, and was very evenly maintained. The extreme limit of variation ranged from 37 degrees to 51 degrees, and these extremes were only reached on two or three occasions. The ventilation was at all times satisfactory.

The general results of the experiments may be summarised as follows :—

1. Apples, midseason and late variety of pears, solid-fleshed plums and tough skinned fleshy grapes may be kept in perfect condition

without any appreciable loss for a period of two months, when stored in a cold dry fresh air, maintained at an even average temperature of 41 degrees to 43 degrees; provided that the fruit is carefully gathered, handled, and packed, and that all blemished fruit is discarded. Apples will keep equally as well if the temperature is raised 10 degrees, but the other fruits require the lower temperature. Two months allows for the extreme outside time required to place the fruit on the English market.

2. After being removed from the cold storage, the fruit keeps in good condition for a sufficient time to enable it to be disposed of and consumed, with only a small percentage of loss, provided that previous to its removal from cold storage the temperature of the store is gradually raised to that of the outside air, as any condensation of moisture on the fruit, which would tend to create decay, is thereby prevented.

3. Soft fruit, such as peaches and nectarines, may be safely stored without deterioration from one to two weeks, according to variety, thereby preventing to a certain extent the glutting of the markets with these fruits during the height of the season.

4. The cost of cold storage by the method employed is much less than that at present used for the conveyance of fruit to England and the results are much better. At present the three great drawbacks Australian fruit-growers have to compete with in the export of fruit to the English market are: first, the excessive freight; second, the large percentage of loss arising through the fruit being carried without a proper system of ventilation; and thirdly, through the bad-keeping qualities of the fruit when landed, which necessitates the fruit being disposed of and consumed as rapidly as possible. All these drawbacks would be, to a great extent, prevented if the fruit were carried under similar conditions to those maintained during the experiments, and a cheaper and better carriage would tend to greatly increase our export of fruit to England, which, unless such steps are shortly taken, threatens to become a thing of the past, as the prices received for our fruit in London are entirely prohibitive in the majority of cases. No doubt this is not always the fault of the high freight and bad system of carriage employed, but is often largely due to the carelessness of the growers or shippers themselves in sending worthless and inferior fruits; and this was shown many times in last year's shipments of Tasmanian apples. The English market wants one class of fruit only, the best, and that fruit put on the market in the best condition and most attractive manner; and if growers or shippers try to palm off any inferior grades they will get left every time, as the English buyers will not have them, except at very low rates.

The value of these experiments to the New South Wales fruit-grower is that by this means the Government have practically shown the conditions that are necessary to maintain in order to successfully keep fruit in cold storage, and also what fruits are most suitable, and what care is necessary to be taken with the grading, wrapping, and packing of the fruits so as to render them suitable for cold storage, especially as adapted to an export trade. It is to an export trade that the fruit-growers must eventually look if the industry is to take a prominent place in colonial industries; and by showing how the export of fruit may be most economically and successfully carried out these experiments are likely to be of great value to the fruit-growers and to the Colony in general.

CCCXC.—SISAL HEMP AT THE BAHAMAS.

The following information respecting a machine for extracting the fibre from leaves of *Agave rigida* var. *sisalana*, grown in the Bahamas, will prove of considerable interest. The machines hitherto tried to extract this fibre have not realised expectations, and some anxiety has in consequence been felt in regard to the future of this important fibre industry. The plantations established in the Bahamas are now arriving at such a stage that a successful machine to extract the fibre is a matter of the greatest importance. The information supplied to the Colonial Office by His Excellency the Governor, would appear to show that the "Todd" machine has, so far, proved so satisfactory that it is likely to be universally adopted in the Colony:—

COLONIAL OFFICE to ROYAL GARDENS, KEW.

SIR, Downing Street, 19th May 1894.

WITH reference to your letter of the 7th July 1893, I am directed by the Marquess of Ripon to transmit to you a copy of a despatch from the Governor of the Bahamas reporting upon a fibre-extracting machine which is now in successful operation in that Colony.

Lord Ripon proposes to forward a copy of Sir Ambrose Shea's despatch to the Governor of Fiji, and his Lordship would be glad if you would be good enough to add any observations which would be likely to be of assistance to Sir John Thurston.

I am, &c.
(Signed) EDWARD WINGFIELD.

The Director,
Royal Gardens, Kew.

GOVERNOR OF THE BAHAMAS to COLONIAL OFFICE.

Government House, Nassau, N.P.,
24th April 1894.

MY LORD,

WITH reference to communications, verbal and otherwise, that I have received from the Colonial Office during the past three years, on the subject of machines for the extraction of fibre, on which information was desired for the Fiji Government, I have now the honour to acquaint your Lordship that I am at length in a position to speak definitely of a machine that is now in successful operation in this Colony.

2. The machine in question is one manufactured by a Mr. Todd, of New York (address, J. C. Todd, Patterson, New Jersey, U.S.A.), and during my late visit to the Munroe plantation at Abaco, I witnessed its performance, and have no doubt it will be universally adopted here. It dresses the fibre perfectly and with a minimum amount of waste, and though half a ton is all that a single machine will yield as a day's work,

the principle is so sound that all that is necessary is to increase the number to meet any required needs.

3. I may observe, however, it does not necessarily follow that the "Todd" machine will be suitable where the conditions of the plant are not similar to ours. I am not informed of the nature of the plant at Fiji, but it may be instructive to know that the leaves of the Bahama plant which hold the fibre are from four to six feet long, that they are free from gum, and the threads separate without combing. Little washing is needed, and the whole process of extracting, washing, and drying is the work of one day.

I have, &c.
(Signed) A. SHEA,
Governor.

The Most Honourable
The Marquess of Ripon, K.G.,
&c., &c., &c.

An account, with an illustration, of the "Todd" fibre extracting machine, is given by Mr. Charles Richards Dodge in Report No. 5, "Fibre Investigations in the United States," issued by the Department of Agriculture in 1893, pp. 25–26. Mr. Dodge states :—

"The only new machine for cleaning Sisal hemp leaves that has been brought to my attention, since the publication of my previous report, is the device patented in 1892 by J. L. Acosta, and manufactured by Joseph C. Todd, Paterson, N.J.

"The claims of the inventor are set forth as follows :—

"'In Fig. 3 is shown clearly the arrangement of the machine for cleaning henequen leaves without the use of crushing cylinders. The operator seats himself before the table and lays the leaves on the feeding chains. Care should be taken to lay the thick ends of the leaves to the right side, with something more than half of the length of the leaf hanging down. The chains will then carry the leaves to the holding belts, by which they will be presented to the first scraping wheel. The leaves having been cleaned for the greater part of their length by the first wheel, a device placed between the two scraping wheels transfers the clean portion of the fibre to the second holding belt, and the remainder is cleaned by the second wheel, leaving no uncleaned or partially cleaned portions in the middle, as is usual in other machines. The leaves of the Pita plant need to be crushed by finely corrugated cylinders in order to separate the fine fibres of the black of a leaf. They should be crushed and scraped while still green and fresh, so that the cleaning may be assisted by the juices of the leaves. Knives or scrapers and brushes in alternation around the wheels are indispensable. It is also desirable to have a pump to furnish water to two small tanks fixed above the upper belts of both wheels. The water flows from these tanks to spread the leaves on the surface of the shoes and to clean and wash the fibres. Otherwise the fibres may be cleaned and washed after being scraped, if it is desirable to avoid the expense of the pump and tanks. With a single man to put the leaves on the feeding chain, and a boy to take away the clean fibre from the end of the machine, it is capable of cleaning thoroughly 50,000 to 60,000 leaves in a day.'

Mr. Dodge adds :—

"I have not seen this machine running on Sisal hemp leaves, but witnessed its work on the leaves of bear-grass (*Yucca filamentosa*) furnished by the Department, the cleaning being accomplished in a thorough manner."

CCCXCI.—GAMBIA PAGNS OR NATIVE CLOTHS.

Next to the cultivation of the ground nut (*Arachis hypogæa*, L.), shipped to Europe for the manufacture of oil, the most important industry of the settlement of the Gambia on the West Coast of Africa is the cultivation and manufacture of cotton. From this cotton is made the native "pagns" or country cloths which are in great request in that part of the world. Sir Alfred Moloney (*Forestry of West Africa*, p. 142) states that in addition to supplying cloths for home consumption the "pagn" industry of the Gambia exported cloths of the value of 480*l.* in 1883 and of 2,742*l.* in 1884. "Pagns" are also made at Lagos, and some of them are exported even to Brazil for the use of the West African negroes who have emigrated to that country. The whole industry is a singularly interesting one. The cotton is gathered, ginned, and spun into thread by the native women entirely by hand. The loom for weaving the cloth is a very crude contrivance. "This "primitive hand-loom," says Sir Alfred Moloney, "in use amongst the "natives is what has come down through centuries to them from their "ancestors, and, it is needless to add, it is capable of improvement to "their advantage. It certainly deserves attention." Each frame weaves a strip of cotton only 6 inches broad. These strips are then sewn into long broad pieces to which the name of "pagn" is applied. The native "pagns" are regarded as extremely durable, and they are in greater request than any similar article of European manufacture. At the request of Kew, his Honour R. B. Llewelyn, C.M.G., Administrator of the Gambia, was good enough to forward, in January last, the subjoined report on the native cotton industry, prepared by Mr. J. H. Ozanne, the Travelling Commissioner on the north bank of the River Gambia:—

CULTIVATION OF COTTON. NORTH BANK, GAMBIA.

Seed is planted as soon as the rains begin. It is planted in rows from 3 to 6 feet apart; the plants are from 2 to 5 feet from one another. Great care is taken in selecting the seed, as it is liable to be attacked by small worms. Corn is planted between the rows, which is reaped in August. By November the cotton plant is 3 feet high, and picking commences and continues until the end of April. There are two sorts of cotton grown in the district, one giving a perfectly white thread, the other a brownish colour like faded ink. The quality of both seems to be the same, but the white cotton yields more. The flower and leaf of both appear exactly the same. The cotton that is grown is not of the best, and would hardly stand the test required by an English cotton spinner, but the plant has the advantage of being able to stand the dry weather, and the clothes made from this cotton are strong and durable. The cotton industry is almost as important as the ground nuts, and the people engaged in it work hard. In every town one comes across a row of cotton-spinners' sheds, each containing a machine. There are generally half-a-dozen of these at work in each town, and the creaking of the machine is heard from morning till night, sometimes even late at night. The cotton is picked by the women clear of seeds, and is beautifully white and clean. The women then take a bundle, mix a little lime or chalk and water on the fingers of the left hand through which the cotton passes, and spin the cotton out on to threads on a spindle which they work with the finger and thumb of the right hand. They do this very quickly, and it looks very easy, but it is not, for when I tried to do it, the threads broke. When they have spun a sufficient quantity of thread, the men choose a flat spot, and place forked sticks about 3 feet high, 40 feet apart, forming three sides of a square, each side being about 150 feet long; the threads are then run from one end to the other, and returned, until there are sufficient rows of thread to be woven into a strip of cotton 6 inches broad. These rolls of thread, 450 feet in length, are now handed over to the owner of the little machine, who so arranges them on two little frames, each about 6 inches wide, that every alternate thread is fastened to a wire of one or the other of the frames. These frames are then set in motion by the workman's foot, and either raise or lower every alternate thread at every stroke. The workman then tosses his shuttle of thread from one hand to the other between the rows of thread. By these means the cross threads are interwoven amongst the long ones, and to press them tightly together, a third little frame, with wires separating the long threads, is pressed against the cross threads. It is difficult to describe this native machine, which should be seen to be appreciated. These strips of cotton are then sewn into long broad pieces which are called "pagns."

J. H. Ozanne.

CCCXCII.—MISCELLANEOUS NOTES.

Albert Linney, a member of the gardening staff of the Royal Gardens, has been appointed gardener for Government House, in the Falkland Islands.

Mr. Walter E. Broadway, formerly a member of the gardening staff of the Royal Gardens, Assistant Superintendent of the Royal Botanical Gardens, Trinidad, has been appointed Curator of the Botanical Garden at Grenada.

Vaccinium hirsutum.—This rare and interesting shrub is now flowering freely in the Kew Arboretum. It is a low-growing bush with hairy stems, leaves, flowers, and fruits. The flowers are greenish-white flushed with rosy red, and the fruit when ripe is shining black and of an agreeable flavour. The history of the re-discovery of this plant by the editors of *Garden and Forest* is given by Professor C. S. Sargent in the journal just mentioned (1889, fig. 119). The Kew plants presented by Professor Sargent, however, are much more vigorous and floriferous than the one which flowered in the Arnold Arboretum and from which the figure in *Garden and Forest* was prepared.

Rubus lasiostylus.—This Chinese species, introduced to cultivation through Dr. Henry, is now flowering in the Rubus collection at Kew. It is a distinct plant with pinnate leaves, green above and whitish below, and flowers with rosy-purple petals shorter than the long sepals, and with hairy styles. It is apparently quite hardy.

Pyrus crataegifolius.—Both in a wild state and under cultivation this is a rare plant. It is a distinctly ornamental and graceful small tree with white flowers. Botanically it seems to show connecting links with *Crataegus*, in which genus it has indeed been placed by some authors. A specimen in the Arboretum at Kew is now in fine flower; it was raised from seeds collected for Kew by the late H. Groves, of Florence.

Marantas.—A great deal of confusion prevails in gardens in the nomenclature of the dwarf *Scitamineæ*, with variegated leaves. They belong to three genera, *Maranta*, *Myrosma*, and *Calathea*, which differ from one another in inflorescence, bracts, and the structure of the ovary, but which cannot be recognised till the plant reaches the flowering stage. We have flowered lately at Kew *Calathea massangeana*, *kerchoveana*, *devosiana*, *leuconeura*, and *depressa*, and find all these to be true Marantas, nearly allied to *M. bicolor*, Ker., *Bot. Reg.*, tab. 786. We have also flowered *Calathea vestita* and *flavescens*, and find these to be true Calatheas.

Omar Khayyam's Rose.—Omar Khayyam is one of the classical Persian poets. He flourished about the time of William the Conqueror. His poems were translated into English a generation ago by Edward Fitzgerald, the friend of Tennyson, and he now numbers, both in this country and the United States, a band of warm admirers. In 1884 some fruits were brought to England from the roses that are planted on his grave at Naishapur, in Persia, by Mr. William Simpson, the well-known artist of the *Illustrated London News*. Some of these fruits were presented to the Royal Gardens by Mr. Bernard Quaritch, and the bush which grew from them, of which cuttings were sent a year ago to plant on the grave of Fitzgerald, in Suffolk, has now flowered for the first time. The plant proves to be a form of *Rosa centifolia*, the sweetest scented of all the roses, from which the cabbage rose, the moss rose, and the pompon are derived. The native country of the plant is not known with certainty, but it was considered by Bieberstein to be truly wild in the Caucasus, and was found by Haussknecht in a semi-double form at an elevation of 3,500 feet, amongst the mountains of Assyria. Omar Khayyam's plant has fully double flowers and evidently belongs to a long cultivated race.

A "Diarrhœa Plant."—The Rev. Dr. Warre, Head Master of Eton College, has sent a few fruits, containing apparently living seeds, of a shrub inhabiting northern Central Australia, where they were collected by Mr. L. G. Browne, who writes that the natives employed it with good effect in cases of diarrhœa. We have not succeeded in identifying it, though Mr. Browne states that he understood that the bush was generally spread in North Australia. So far as the materials goes, it may be a small-fruited species of *Zizyphus*, near *Z. Œnoplia*, which is widely spread in Tropical Asia and Australia. Perhaps this record may lead to its identification. In India the bark of *Zizyphus Jujuba* is applied to a similar purpose, and all the species are probably astringent.

The collection of portraits of distinguished botanists and travellers which has been accumulating for many years past, and a small portion of which is exhibited in Museum No. 1, has recently received an addition in the form of a platinotype photograph of Mr. Giles Munby, which has been kindly presented to the Museum of the Royal Gardens by one of his daughters, Mrs. Cundell.

Mr. Munby, who was born at York in the year 1813, was well known for his botanical travels and explorations in France and Algeria. In the last-named country he resided for a period of 21 years and published a valuable work on its flora.

After his death, which occurred at his residence, The Holt, near Farnham, in 1876, his herbarium was presented by his family to the Royal Gardens, together with a selection of living plants which had been cultivated by him in his own garden.

Mr. Bent's Expedition to the Hadramaut Valley.—It was announced in the *Kew Bulletin* for 1893, p. 366, that Mr. W. Lunt, a member of the gardening staff, was to accompany Mr. Bent in the capacity of botanical collector. The expedition was successful, but the opposition of the natives limited the extent of the explorations. The members reached England, on their return, towards the end of April. Mr. Lunt's botanical collections were excellently prepared and preserved, and contain many interesting novelties, including two new genera and new species of such genera as *Aloe*, *Adenium*, *Arthrosolen*, *Littonia*, *Statice*, and *Vellozia*. Mr. Baker, the keeper, and other members of the Herbarium staff are engaged working out the dried plants, the first received from South Arabia, eastward of Aden, except a few odd scraps picked up by various travellers. The Western Province of Yemen was botanised by Forskal in 1768, and quite recently by Deflers and Schweinfurth, with the result that the flora proves almost identical with that of Abyssinia. Mr. Bent's expedition penetrated as far north as Al Had, on the sixteenth parallel.

California.—At the instance of the United States Department of Agriculture an expedition was sent in 1891 to investigate the natural history of the Death Valley, California. To this expedition Mr. F. V. Coville was attached as botanist, and he has now published a full report of the botanical results, which occupies the fourth volume of "Contributions from the United Stated National Herbarium." The Death Valley is situated between 36° and 37° N. lat. and 117° and 118° W. long., being bounded on the east by the Amargosa and Funeral Mountains and on the west by the Pinto and Panamint ranges. The temperature of this region is subject to great variation. In July the mean daily shade temperature was 102° Fahr., while in August the average daily range was 32°, and occasionally at night freezing point was reached. The expedition did not confine its attention to the Death Valley, but also explored part of the surrounding region, the whole resulting in the collection of the 1,261 species enumerated in the report. The plants collected in the Death Valley consist of 2 arboreous species, 58 shrubby species, 40 perennial and 104 annual herbs. The only trees in this region are *Yucca arborescens* and *Y. macrocarpa*. The former (a photograph of which forms the frontispiece of the volume) attains a height of 25 feet with a trunk 2 feet in diameter; *Y. macrocarpa* rarely exceeds 15 feet in height. Forty-two new species of plants have been described and two new genera made. One of these, *Orochænactis*, is founded on a species formerly referred by A. Gray to *Chænactis*, the other, *Phyllogonum*, is allied to *Eriogonum*. An essay on the "Principles of plant distribution," together with two others on the distribution of the plants over the region traversed, and the characteristics and adaptations of the desert flora, form important additions to the literature of this subject. The report is illustrated with 21 plates and contains a map of the region, with an index to the principal places mentioned therein, also a full bibliography and an index to the species. Through the kindness of Mr. Coville a set of the plants collected during this expedition has been presented to Kew.

Fiji.—Sir J. B. Thurston, K.C.M.G., Governor of Fiji, has forwarded specimens of two species of *Pandanus* found by him in Fiji. One of these appears to be the rare *Pandanus Joskei*, J. Horne, found but once previously in Fiji by Mr. Horne, late Director of the Department of Forests and Botanic Gardens, Mauritius. The other is an undescribed species belonging to the section *Rychia*.

Annals of the Royal Botanic Garden, Calcutta.—The fourth volume of this valuable publication has appeared. It consists of a fully illustrated monograph of the *Anonaceæ* of British India, by Dr. G. King, the Superintendent of the Garden; and it may fairly be characterised as a most valuable contribution to botanical literature. There are few more difficult natural orders than the *Anonaceæ*, even among those consisting entirely of arboreous and shrubby plants; and it is almost impossible to identify species without figures or access to the specimens on which the species were founded. Dr. King describes about 270 species, belonging to 27 genera, and a figure, including floral dissections, is given of each species. A large number of the species are new, though not always described here for the first time; yet with all this wealth of new species Dr. King has introduced very few alterations in the genera, as defined in Bentham and Hooker's *Genera Plantarum*, and adopted in Hooker's *Flora of British India*. *Lageræa* has been restored to generic rank, and *Griffithia*, proposed, but not published, by the late Dr. Maingay for *Polyalthia magnoliæflora*, has also been taken up. The only other generic change is the substitution of the recent *Canangium*, Baillion, for the old *Cananga* of Rumphius, on account of the existence of the properly defined *Cananga* of Aublet, belonging to the same natural order; but Dr. King seems to have disregarded the fact that Dr. Baillon proposed the name *Canangium* as a section of the genus *Unona*.

This volume of the *Annals*, published on the hundredth anniversary of the death of Colonel Robert Kyd, is dedicated to him, to whom India is indebted for the foundation of the garden in 1787. Colonel Kyd's scheme for founding a garden of acclimatization was warmly taken up by the then Governor-General, Sir John Macpherson, and subsequently by the Court of Directors of the Honourable East India Company, mainly because it included the introduction and propagation of valuable economic plants for cultivation in the territories subject to the Company. Dr. King gives a portrait of the founder and a brief sketch of his career.

Rubus ellipticus, Smith (*R. flavus*, Ham.). This, an Indian *Rubus*, native of the temperate and sub-tropical Himalaya, where it extends from 2–7,000 feet elevation. It is also found in Ceylon and in Yunnan. It is a sub-erect shrub with stout branches covered with red-brown hairs. The flowers are white and the fruit golden yellow. The plant appears to have been introduced to Queensland, and the following account of it is taken from the Annual Report of the Acclimatization Society for the year ending March 31st, 1892:—

Rubus flavus.—From seeds received from the Botanical Gardens, Saharanpur, India. Several plants of this raspberry were raised, and during the past year the specimen plant that was placed outside has fruited. The plant grows most luxuriantly, and fruits freely. The fruit are borne on the terminal shoots of the current year's growth, and form loose panicles, containing from 6 to 18 separate fruits on each; they are of a pale yellow colour when ripe, and possess the full raspberry flavour, with a delightful subacidity which renders them most palatable when eaten raw. A small quantity was made into jam, which turned out well as regards flavour, but the colour was not desirable; this could, of course, be overcome by the addition of colouring matter. Several plants have been sent to various parts of the colony, and seem to thrive equally in inland, upland, and coast land localities. It is a plant of very robust growth, making shoots from an inch in diameter at the base, and from 8 to 12 feet long. It is most easily propagated from layers, and needs no particular treatment in cultivation. From its strong growing habit and the fact that it is armed with formidable spines, it is a most suitable plant for placing round the boundary fences of orchards to exclude marauders. In appearance the plant is rather ornamental; it is evergreen, with very pretty soft green foliage—the young shoots being clothed with a dense mass of beautiful dark-red downy-looking hairs. Experiments are being carried out with the plant as regards how it will bear pruning, the idea being to see whether it will increase or diminish its fruit-bearing qualities. If it will stand hard cutting its value as a fence plant will be considerably increased. The Society have a stock of plants ready for distribution, and recipients are admonished to give the plant a fair trial, and report results.

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 91.] JULY. [1894.

CCCXCIII.—COMINO TREES OF COLOMBIA.

(*Aniba perutilis*, Hemsl.)

In the December number, 1892, of the United States Consular Reports there appeared an account of the "Comino" tree of Colombia supplied by Mr. Luciano Santa Maria, the U.S. Vice-Consul at Medellin. The tree (or trees, for more than one kind of Comino was referred to) produced an excellent timber for building purposes as well as for the use of cabinet-makers. The trees were said to be both valuable for timber as well as very ornamental. As the particulars supplied in the Report were not sufficient to identify the trees, application was made to the Foreign Office to obtain a complete set of specimens through Her Majesty's Vice-Consul at Barranquilla. The specimens were duly received from the Vice-Consul (Mr. William Gordon) in November, 1892. It was shown that both "*Comino liso*" and "*Comino crespo*" were obtained from one species, the only difference existing in the hardness and in the superior grain of the latter rendering it more suitable for cabinet purposes. A similar difference it may be mentioned exists in the mahogany known as "baywood," a soft loose-grained timber growing in moist rich soils of Honduras, and the "flowered mahogany" growing in rocky soils in the same country and in San Domingo and Cuba.

The Herbarium specimens of the "Comino" received from Mr. Gordon proved to be an undescribed *Laurinea*, which was described in the *Kew Bulletin*, 1894, p. 7, as *Aniba perutilis*, Hemsl. Evidently, however, the name "Comino" is not restricted to this species of *Aniba* (*Aydendron*), as a very different species of the same genus in the Kew Herbarium, collected in Colombia by the late Dr. J. Triana (No. 2,040), is labelled "*Aydendron*. 'Laurel Comino.' "Andes de Antioquia, Medellin, alt. 1,540." This has relatively large broad leaves, and is distinguishable at a glance from *Aniba perutilis*.

Specimens of the timber of "Comino liso" and "Comino crespo," sent by Mr. Gordon, at the same time as the Herbarium specimens, are in the Kew Museum.

The following Report and correspondence furnish all the particulars so far available in regard to the valuable Comino trees which have hitherto apparently received little or no notice outside the country in which they grow:—

U.S. CONSULAR REPORTS, December 1892, pp. 614-615.

THE COMINO TREE OF COLOMBIA.

By parcel post I forward a small box made of "Comino crespo," containing seeds of this beautiful tree, which, I presume, does not exist in the United States.

This tree, called "Comino," produces an excellent wood for the use of cabinet-makers, and possesses some exceptional properties, not only for high-class furniture, but for building purposes. The common kind of Comino is very much appreciated for house building, its merit being that it is a perfect proof against all wood-destroying insects so prevalent in this part of Colombia. It is a well-known fact that all kinds of timber used for building purposes in this country are assailed and destroyed within a short space of time by insects called "Comejen," a winged insect; and a house built of common timber is fought shy of by all purchasers of property, whereas property built of comino timber will stand strong and unchanged for ages, and is unaffected by either insects, water, soil, or climate.

There is another kind of Comino wood, having the same properties as above described, but commanding a very high price and used mostly for veneering purposes. It is of a beautiful dark and light undulating colour of a yellowish tortoise-shell appearance, as will be seen by the small box I send with the seed. High-class furniture veneered with this kind of Comino, called here "Comino crespo," presents a magnificent appearance, always bringing a high price if well worked and properly finished.

This tree is especially grown in the department of Antioquia, and also serves as a handsome ornament to a country place. You will likewise find inside the box of seed some leaves which I have picked from some plants in my country home.

The Comino above described can be successfully cultivated at a temperature of between 18° and 20° C. I have no doubt but that if it can be cultivated and acclimatized in the United States, this beautiful and wonderful tree will be a great and an important acquisition to the American wood-workers.

One fully developed tree of Comino can yield 400 pieces, as follows: 200 boards 9 feet long, 10 inches wide, by 1 inch thick, and each of them can be sold for $1.20; 200 girders 9 feet long, 4 inches wide, by 2 inches thick, and each is sold for $1. Besides, the branches of the tree are utilised for small columns for windows, and for other purposes, and the very thin ones for fuel, although it burns very badly, yielding a great deal of smoke.

The Comino tree is not the *Sandalo citrino* of Ceylon, Brazil, and China, as is believed by some.

(Signed) LUCIANO SANTA MARIA,
Vice-Consul.

United States Consulate,
Medellin, August 16, 1892.

MR. VICE-CONSUL GORDON to ROYAL GARDENS, KEW.

British Vice-Consulate, Medellin (Colombia),
25th September, 1893.

SIR,

ACTING under instructions dated 19th June 1893, from Her Majesty's Minister in Bogotá, I have the honour to advise, having forwarded through the British Vice-Consul in Barranquilla, to your address one small box containing seeds, leaves, branches, and bark from the tree known here as "Comino," as per statement enclosed.

Of this Comino tree there are two kinds which are appreciated in this country, or rather in this part of Colombia where there exists an insect called by the name of "Comejen," which perforates and destroys all kinds of wood, except the Comino. Of the two kinds of Comino, one is called "Comino liso," or plain Comino; the other is called here "Comino crespo," or Comino of a shaded appearance. The former is used for building purposes, the latter for veneering furniture.

Both kinds are identical in so far as the tree is concerned. The leaves, branches, seeds, &c., are the same. The connoisseurs inform me that it is due to a disease in the tree, or in the roots of the tree, that makes the wood shaded or of a wavy appearance and most beautiful for veneering purposes.

The plain Comino is found in abundance in the forests, but the "crespo" or fancy wood is rather scarce.

I will be pleased to get any other information you may need.

I am, &c.
(Signed) WILLIAM GORDON.

The Director,
Kew Gardens, London.

CCCXCIV.—ARTIFICIAL PRODUCTION OF CITRIC ACID—(*Continuation*).

In the *Kew Bulletin*, 1894, pp. 103–108, an account was given of the artificial production of citric acid from a sugar solution by growing in it a fungus, one of the "moulds." The discovery was regarded as of more than theoretical interest, as it might affect important cultural industries in the south of Europe and in the West Indies, where the lemon and lime were largely grown for the production of citric acid from the juice of their fruits. The subsequent history of the discovery appears to show "that difficulties have been encountered which "must be overcome before there can be any real question of the commercial utilisation of the process."

In a letter, dated the 17th May 1894, received from Dr. H. A. Alford Nicholls, F.L.S., of Dominica, where the question of the artificial manufacture of citric acid is regarded with great anxiety, the following opinion is quoted from Messrs. Burgoyne, Burbidges & Co., the well-known wholesale pharmacists, of London :—

"*Artificial Citric Acid.*—We do not consider that you need be under the slightest apprehension concerning this article. It has been produced certainly, but more as a scientific experiment, and, so far as we can judge, is not likely to become an item of commerce. You need not fear that the discovery menaces the lime fruit industry at present; and, as we have already remarked, we do not believe that an artificial will ever supersede the natural acid."

The following official correspondence has been received on the same subject:—

COLONIAL OFFICE TO ROYAL GARDENS, KEW.

Downing Street,
June 23, 1894.

SIR,

I AM directed by the Secretary of State for the Colonies to transmit to you, with reference to your letter of April 19th last, the accompanying copy of a despatch from Her Majesty's Ambassador at Berlin, addressed to the Earl of Kimberley, respecting the artificial production of citric acid at the Manufactory of Chemical Products at Thann, in Alsace.

I am, &c.
(Signed) R. H. MEADE.

The Director,
Royal Gardens, Kew.

HER MAJESTY'S AMBASSADOR AT BERLIN TO THE FOREIGN OFFICE.

MY LORD,
Berlin, June 13, 1894.

WITH reference to your Lordship's despatch, No. 29, Commercial, of the 28th April last, I have the honour to state that, according to a communication which I have received from the Imperial Foreign Office, experiments have been made at the Manufactory of Chemical Products at Thann, in Alsace, in the artificial production of citric acid. The Director of that establishment states that the result of these experiments increases the prospect of ultimate success, but that certain difficulties have been encountered which must be overcome before there can be any question of the mercantile utilisation of the process in question.

I have, &c.
(Signed) E. B. MALET.

The Earl of Kimberley, K.G.,
&c. &c. &c.

CCCXCV.—SUPPLEMENTARY NOTE TO THE FLORA OF BRITISH INDIA.

This note contains references to be added to the *Flora of British India* from the paper of ROTTLER and WILLDENOW, 1803, for which we are indebted to Mr. C. B. Clarke, F.R.S., and Dr. Stapf.

The German Missionary Rottler travelled from Tranquebar 24 Sept. 1799, to Madras, and returned to Tranquebar 16 Jan. 1800. He wrote an account, noticing about 250 plants, giving descriptions of the new species and of one new genus, which was published in *Neue Schriften der Gesellschaft Naturforschender Freunde zu Berlin IV.* [1803] pp. 180–224, tab. *III.–V.*, by Willdenow; who added a commentary of his own, containing improved diagnoses, new names, &c. This paper is not in the Kew Library, and Mr. Daydon Jackson, the compiler of the "*Index Kewensis*," knows of only two copies in England.

This is the oldest account of a botanic collection and excursion in India, and the names in it have priority over those even in Roxburgh's *Hortus Bengalensis.* But Rottler's paper not being at Kew, the citations of it in the *Flora of British India* were made at second hand, and the present list has therefore been prepared for reference. In De Candolle's *Prodromus*, from which the citations are usually made, their source is given in the latin form, equivalent to the German title, *Nov. Act. Nat. Cur. Berol.* which is likely to be confused with the *Nova Acta Phys. Medic. Acad. Cæsar. Leopold-Carol. Naturæ Curiosorum,* the other German quarto journal of the period.

Rottler's Herbarium came into the possession of Kew from King's College, London, in 1872, and it contains many of the identical plants collected on Rottler's journey in 1799–1800 between Madras and Tranquebar. The names of Rottler, cited in the *Flora of British India*, are thus generally right, while the reference is often wrong. In the following list of corrections we have marked (!) against the names where we have found the original plant of Rottler at Kew. As regards the genus *Suregada*, Bentham [in Benth. and Hook. f. *Gen. Pl.* III. 324] while giving the correct reference to it, says *Suregada, nomen tantum*, and therefore takes up the much later name *Gelonium.* But the fact is that the description of the genus *Suregada* by Rottler is full and good, and the name *Suregada* is accepted by Baillon.

Only those plants of Rottler and Willdenow are mentioned upon which a correction or addition is to be made to the *Flora of British India ;* but the grasses not being yet published are all cited.

Artabotrys odoratissimus, *R. Br. ; Fl. Brit. Ind.* I. p. 54. Uvaria esculenta, *Rottl. et Willd. in Neue Schriften*, IV. p. 201.

Capparis zeylanica, *Linn. ; Fl. Brit. Ind.* I. p. 174. C. rotundifolia, *Rottl. et Wild. ! in Neue Schriften*, IV. pp. 185–6.

Tamarix gallica, *Linn. Fl. Brit. Ind.* I. p. 248. T. indica, *Willd. ! in Neue Schriften*, IV. p. 214.

Tamarix ericoides, *Rottl. ; Fl. Brit. Ind.* I. p. 249 ; *Rottl. in Neue Schriften*, IV. p. 214, t. 4.

Pavonia odorata, *Willd. ; Fl. Brit. Ind.* I. p. 331. Hibiscus morifolius, *Rottl. et Willd. ! in Neue Schriften*, IV. pp. 209 and 212.

Grewia tiliæfolia, *Vahl. ; Fl. Brit. Ind.* I. p. 386. G. arborea, *Roxb. ex Rottl. in Neue Schriften*, IV. p. 205.

Grewia orbiculata, *Rottl. ; Fl. Brit. Ind.* I. p. 386 ; *Rottl. in Neue Schriften*, IV. p. 205.

Grewia villosa, *Willd. ; Fl. Brit. Ind.* I. p. 388 ; *Willd. ! in Neue Schriften*, IV. p. 205.

Erythroxylon monogynum, *Roxb. ; Fl. Brit. Ind.* I. p. 414. E. areolatum, *Rottl. in Neue Schriften*, IV. p. 220, not of Linn.

Reinwardtia trigyna, *Planch. ; Fl. Brit. Ind.* I. 412. Linum ? trigynum, *Rottl. ! in Neue Schriften*, IV. p. 199.

Biophytum sensitivum, *D.C. ; Fl Brit. Ind.* I. p. 436. Oxalis sensitiva, *L.*

Chickrassia tabularis, *A. Juss.; Fl. Brit. Ind.* I. p. 568. Cedrela odorata, *Willd. in Neue Schriften*, IV. p. 198.

Salacia prinoides, *D.C.; Fl. Brit. Ind.* I. p. 626; Tonsella prinoides, *Willd. in Neue Schriften*, IV. p. 184.

Vitis repanda, *W. et A.; Fl. Brit. Ind.* I. p. 648. Cissus indica *Rottl. et Willd. in Neue Schriften*, IV. p. 183. (See W. et A. Prod. p. 125.)

Allophyllus Cobbe, *Blume; Fl. Brit. Ind.* I. p. 673. A. racemosus, *Rottl.! in Neue Schriften*, IV. p. 219 has priority.

Buchanania angustifolia, *Roxb.; Fl. Brit. Ind.* II. p. 23. Spondias simplicifolia, *Rottl.! in Neue Schriften*, IV. p. 187.

Odina Wodier, *Roxb.; Fl. Brit. Ind.* II. p. 29. O. pinnata, *Rottl. in Neue Schriften*, IV. p. 209 *in Obs.* This being only a nomen nudum should not be given priority.

Crotalaria hirta, *Willd.; Fl. Brit. Ind.* II. p. 70; *Willd. in Neue Schriften*, IV. p. 217. We have failed to find the name "C. pilosa, *Rottl.*" in Rottler's present paper.

Crotalaria medicaginea, *Lamk.; Fl. Brit. Ind.* II., p. 81. C. foliosa, *Willd. in Neue Schriften*, IV. p. 217. Indigofera foliosa, *Rottl. in Neue Schriften*, IV. p. 217.

Crotalaria Trifoliastrum, *Willd.; Fl. Brit. Ind.* II. p. 82. *Rottl. in Neue Schriften*, IV. p. 223 t. 5.

Crotalaria orixensis, *Rottl.; Fl. Brit. Ind.* II. p. 83; *Rottl. in Neue Schriften*, IV. p. 217.

Pseudarthria viscida, *W. et A.; Fl. Brit. Ind.* II. p. 154. Glycine viscida, *Willd. in Neue Schriften*, IV. p. 208.

Rhynchosia rufescens, *D.C.; Fl. Brit. Ind.* II. p. 220. Glycine rufescens, *Willd. in Neue Schriften*, IV. p. 222. Hedysarum rufescens, *Rottl. in Neue Schriften*, IV. p. 222.

Rhynchosia aurea, *D.C.; Fl. Brit. Ind.* II. p. 221. Glycine aurea, *Willd. in Neue Schriften*, IV. p. 218. Hedysarum aureum, *Koenig ex Rottl. in Neue Schriften*, IV. p. 218.

Rhynchosia suaveolens, *D.C.; Fl. Brit. Ind.* II. p. 221. Hedysarum venosum, *Rottl. in Neue Schriften*, IV. p. 220.

Rhynchosia densiflora, *D.C.; Fl. Brit. Ind.* II. p. 226. Hedysarum punctatum, *Rottl. in Neue Schriften*, IV. p. 222.

Pterocarpus Marsupium, *Roxb.; Fl. Brit. Ind.* II. p. 239. Pt. flavus, *Rottl. in Neue Schriften*, IV. p. 188, non Lour. (We are unable to reduce Pt.? furvus, *Roxb. ex Rottl. in Neue Schriften*, IV. p. 204.)

Cæsalpinia digyna, *Rottl.; Fl. Brit. Ind.* II. p. 256; *Rottl. et Willd.! in Neue Schriften*, IV. p. 200 t. 3. C. oleosperma, *Roxb. ex Rottl. in Neue Schriften*, IV. p. 200. (Mimosa paniculata, *Rottl. in Neue Schriften*, IV. p. 214, not of Willd.? We cannot reduce this.)

Acacia tomentosa, *Willd.; Fl. Brit. Ind.* II. p. 291. Mimosa tomentosa, *Rottl. in Neue Schriften*, IV. p. 208.

Acacia leucophlæa, *Willd.; Fl. Brit Ind.* II. p. 294. Mimosa alba, *Roxb. ex Rottl.* and M. ferruginea, *Rottl. in Neue Schriften*, IV. p. 208.

Acacia Sundra, *D.C.; Fl. Brit. Ind.* II. p. 295. Mimosa Chundra, *Roxb. ex Rottl. in Neue Schriften*, IV. p. 207.

Lumnitzera racemosa, *Willd.; Fl. Brit. Ind.* II. p. 452; *Willd. in Neue Schriften*, IV. p. 187. Jussieua racemosa, *Willd.! in Neue Schriften*, IV. p. 186.

Cucumis trigonus, *Roxb.; Fl. Brit. Ind.* II. p. 619. Bryonia callosa (collosa by typogr. error) *Rottl.! in Neue Schriften*, IV. p. 210.

Cephalandra indica, *Naud.; Fl. Brit. Ind.* II. p. 621. Bryonia alceæfolia, *Willd.! in Neue Schriften*, IV. p. 223.

Rhynchocarpa fœtida, *Schrad.; Fl. Brit. Ind.* II. p. 627. Bryonia rostrata, *Rottl. et Willd.! in Neue Schriften*, IV. p. 212.

Corallocarpus epigæa, *Hook. f.; Fl. Brit. Ind.* II. p. 628. Bryonia epigæa, *Rottl. et Willd.! in Neue Schriften*, IV. p. 223.

Trianthema crystallina, *Vahl.; Fl. Brit. Ind.* II. p. 660. T. triquetra, *Rottl.! in Neue Schriften*, IV. p. 181.

Oldenlandia brachiata, *Wight; Fl. Brit. Ind.* III. p. 66. O. pusilla, *Rottl.! in Neue Schriften*, IV. p. 216. Hedyotis attenuata, *Willd. in Neue Schriften*, IV. p. 216.

Randia dumetorum, *Lamk.; Fl. Brit. Ind.* III. p. 110. Gardenia stipularis, *Rottl. et Willd. in Neue Schriften*, IV. p. 182.

Canthium didymum, *Gaertn.; Fl. Brit. Ind.* III. p. 132; *Gaertn. Fruct.* III. p. 94 t. 196. Webera cymosa, *Rottl.! in Neue Schriften* IV. p. 188. Canthium cymosum, *Pers. Syn.* I. p. 200.

Spermacoce hispida, *Linn., Fl. Brit. Ind.* III. p. 200. S. hirta, *Rottl.! in Neue Schriften*, IV. p. 195.

Jasminum rigidum, *Zenk.; Fl. Brit. Ind.* III. p. 598. J. cuspidatum, *Rottl. et Willd.! in Neue Schriften*, IV. p. 192 has priority.

Wrightia tinctoria, *Br.; Fl. Brit. Ind.* III. p. 653. Nerium tinctorium, *Roxb. ex Rottl. in Neue Schriften*, IV. p. 198.

Sarcostemma intermedium, *Decne.; Fl. Brit. Ind.* IV. p. 27. Cynanchum viminale, *Rottl. in Neue Schriften*, IV. p. 1888, not of Linn.

Argyreia cymosa, *Sweet; Fl. Brit. Ind.* IV. p. 190. Convolvulus malabaricus, *Rottl.! in Neue Schriften*, IV. pp. 211 et 216, not of Linn.

Ipomœa coccinea, *Linn.; Fl. Brit. Ind.* IV. p. 199. I. phœnicea, *Roxb. ex Rottl.! in Neue Schriften*, IV. p. 197. I. angularis, *Willd.! in Neue Schriften*, IV. p 197.

Ipomœa obscura, *Ker; Fl. Brit. Ind.* IV. p. 207. Convolvulus gemellus, *Rottl. in Neue Schriften*, IV. 216.

Ipomœa Beladamboe, *Roem. et Sch.; Fl. Brit. Ind.* IV. p. 209. Convolvulus rugosus, *Rottl.! in Neue Schriften*, IV. pp 196 et 212.

Ipomœa pilosa, *Sweet; Fl. Brit. Ind.* IV. p. 213. Convolvulus pilosus, *Rottl. et Willd. in Neue Schriften*, IV. p. 196.

Ipomœa palmata, *Forsk.; Fl Brit. Ind.* IV. p. 214. Convolvulus heptaphyllus, *Rottl. et Willd. in Neue Schriften*, IV. p. 215.

Physalis peruviana, *Linn.; Fl. Brit. Ind.* IV. p. 238. Ph. esculenta, *Roxb. ex Rottl. in Neue Schriften*, IV. p. 197.

Limnophila polystachya, *Benth.; Fl. Brit. Ind.* IV. p. 269. Stemmodia aquatica, *Willd.! in Neue Schriften*, IV. p 213.

Dopatrium nudicaule, *Ham.; Fl. Brit. Ind.* IV. p. 274. Gratiola nudicaulis, *Rottl. et Willd.! in Neue Schriften*, IV. p. 193.

Lepidagathis cristata, *Willd.; Fl. Brit. Ind.* IV. p. 516. Acanthus cristatus, *Koenig ex Rottl.! in Neue Schriften*, IV. p. 204.

Justicia glauca, *Rottl.; Fl. Brit. Ind.* IV. p. 529; *Rottl. in Neue Schriften*, IV. p. 219.

Rhinacanthus communis, *Nees; Fl. Brit. Ind.* IV. p. 541. Justicia dichotoma, *Rottl. in Neue Schriften*, IV. p. 221.

Priva leptostachya, *Juss.; Fl. Brit. Ind.* IV. p. 565. Verbena Forskaelii, *Rottl. in Neue Schriften*, IV. p. 222.

Vitex alata, *Heyne; Fl. Brit. Ind.* IV. p. 584. V. alata, *Willd. in Neue Schriften*, IV. p. 203. V. appendiculata, *Rottl. in Neue Schriften*, IV. p. 203, which name should be taken.

Ocimum adscendens, *Willd.; Fl. Brit. Ind.* IV. p. 609. O. verticillatum, *Rottl.! in Neue Schriften*, IV. p. 202.

Celosia patula, *Willd.; Fl. Brit. Ind.* IV. p. 716; *Willd. in Neue Schriften*, IV. p. 198. C. glauca, *Rottl. in Neue Schriften*, IV. p. 198.

[Euphorbia glaucescens, *Willd.* (*i.e.*, E. rosea, *Rottl.* not of *Retz*) *in Neue Schriften*, IV. p. 183. Not taken up in *Hook. f. Fl. Brit. Ind.* Boissier, in *D.C. Prod.* XV. *part* 2, p. 116, reduces it to E. Gerardiana, *Jacq.*, which appears doubtful.]

Acalypha alnifolia, *Klein; Fl. Brit. Ind.* V. p. 415. A. capitata, *Willd.! in Neue Schriften*, IV. p. 220, which name has priority. A. tomentosa, *Willd. in Neue Schriften*, IV. p. 220.

Mallotus repandus, *Muell. Arg.; Fl. Brit. Ind.* V. p. 442. Croton repandum, *Rottl.*

Mallotus rhamnifolius, *Muell. Arg.; Fl. Brit. Ind.* V. p. 440. Croton rhamnifolius, *Willd.! in Neue Schriften*, IV. p. 190. Croton nervosus, *Rottl.!*

Gelonium, *Fl. Brit. Ind.* V. p. 458, is Suregada, *Roxb. ex Rottl.! in Neue Schriften*, IV. p. 206, and G. multiflorum, *A. Juss.*, G. lanceolatum, *Willd.*, and G. glomerulatum, *Hassk.* (*Fl. Brit. Ind.* V. pp. 459–460) must be replaced by Suregada multiflora, *Baill.*, S. angustifolia, *Baill.*, and S. glomerulata, *Baill.*, respectively.

Ficus heterophylla, *Linn. f.; Fl. Brit. Ind.* V. p. 518. F. repens, *Rottl. et Willd. in Neue Schriften*, IV. p. 208.

Cyanotis papilionacea, *Schult.; Fl. Brit. Ind.* VI. p. 384. Tradescantia cristata, *Rottl. in Neue Schriften*, IV. p. 246.

Cyperus nitens, *Rottl.! in Neue Schriften*, IV. p. 193 is C. Teneriffæ, *Poir.*

Cyperus corymbosus, *Rottl.! in Neue Schriften*, IV. p. 215. The plant collected December 31st, 1799, is C. tegetum, *Roxb.*, but other species are marked "C. corymbosus" in Rottler's herb. propr.

Cyperus fastigiatus, *Rottl.! in Neue Schriften*, IV. p. 210. The plant collected December 30, 1799, is C. exaltatus, *Retz*, but other specimens marked "C. fastigiatus" in herb. Rottl. belong to C. platyphyllus, *Roem. et Sch.*

Cyperus dubius, *Rottl.! in Neue Schriften*, IV. p. 193. The plant collected March 4th, 1800, is C. cephalotes, *Vahl*, but other specimens in herb. Rottl. belong to Mariscus dregeanus, *Kunth.*

Scirpus plantagineus, *Rottl.! in Neue Schriften*, IV. p. 181 is Eleocharis plantaginea, *R. Br.*

Scirpus brevifolius, *Rottl. in Neue Schriften*, IV. p. 190.

Scirpus capillaris, *Rottl. in Neue Schriften*, IV. p. 222 is doubtless the common Sc. capillaris, *Willd.*

Panicum prostratum, *Lam. Ill.* I. p. 171. P. repens, *Burm.* var. alt., *Rottl.! in Neue Schriften*, IV. p. 182.

Panicum repens, *Linn., Sp. Pl. ed.* II. p. 87. P. ischæmoides, *Rottl.! in Neue Schriften*, IV. p. 183.

Panicum miliare, *Lam. Ill. p. 173.* P. Meneri, *Koenig ;* P. miliacei var., *Rottl. ! in Neue Schriften*, IV. p. 183.

Panicum sanguinale, *L.* P. nervosum, *Rottl. ! in Neue Schriften*, IV. p. 194.

Panicum sanguinale, *L.* **var. ciliare,** *Parl.* P. adpressum, *Willd.* [*i.e.*, P. ciliare, *Rottl.!*] in Neue Schriften, IV. p. 193.

Panicum neesianum, *W. et A., Cat.* 2040; *Steud., Gram.* p. 94. P. miliaceum, "var. glumis coloratis. Radices repentes," *Rottl. in Neue Schriften*, IV. p. 194.

Panicum cimicinum, *Retz.; Rottl.! in Neue Schriften*, IV. pp. 191 and 194.

Panicum fluitans, *Retz.* P. brizoides, *Rottl.! in Neue Schriften*, IV. p. 211.

Oplismenus compositus, *Roem. et Schult.* Panicum, P. composito proximum an P. aristatum, *Retz., Rottl.! in Neue Schriften*, IV. p. 224.

Setaria glauca, *Beauv.* Panicum glaucum, *Rottl. ! in Neue Schriften*, IV. p. 193.

Ophiurus corymbosus, *Gaertn. f. Carpol.* III. p. 4 t. 181. Rottboellia corymbosa, *Rottl.! in Neue Schriften*, IV. p. 183. The Kew specimen of this from Rottler's herbarium is accompanied by two labels, one containing the name "Rottboel: corymbosa," the other the note "Kinangu Tam. Ein Rohr, so zum Decken der Haeuser gebraucht wird. Bei Tattenûr. Rottboella corymbosa. R. punctata Retzii Obs bot. 3, p. 12." Both labels are in Rottler's handwriting.

Rottboellia Myurus, *Benth.* Manisurus Myurus, *Rottl.! in Neue Schriften*, IV. p. 191.

Eremochloa muricata, *Hackel.* Ægilops ciliaris, *Koenig ex Rottl. in Neue Schriften*, IV. p. 210.

Andropogon aciculatus, *Willd. in Neue Schriften*, IV. p. 207, *in nota.* A. Gryllus, *Rottl. ! in Neue Schriften*, IV. p. 207. There is no specimen at Kew from the Redhills, the locality indicated by Rottler, but other specimens of an earlier, as well as a later, date are partly A. Gryllus, *L.*, and partly A. aciculatus, *Retz.*

Andropogon Schoenanthus, *Rottl. in Neue Schriften*, IV. p. 207.

Andropogon squarrosum, *Linn. f.* A. asperum, *Rottl. in Neue Schriften*, IV. p. 210.

Aristida depressa, *Retz ; Rottl. in Neue Schriften*, IV. p. 195.

Milium tomentosum, *Koenig ex Rottl. in Neue Schriften*, IV. p. 220. We have not found Rottler's specimen, but a plant of Wallich's Herbarium, No. 8695 A., named "Milium tomentosum, Hb. Heyne," agrees with Rottler's description. This, however, is Panicum subeglume, *Trin.*

Sporobolus coromandelianus, *Kunth.* Agrostis coromandelina, *Rottl.! in Neue Schriften*, IV. p. 194.

Enteropogon melicoides, *Nees.* Ischæmum melicoides, Koenig, an Chloridis sp.? *Rottl. in Neue Schriften*, IV. p. 211.

Ischæmum laxum, *R. Br.* Andropogon nervosum, *Rottl. in Neue Schriften*, IV. p. 218.

Melanocenchris Perrottetii, *Jaub et Spach.* Pommereullia monoica. Gracilea nutans, *Koenig ex Rottl. in Neue Schriften*, IV. p. 218.

Eragrostis nutans, *Nees in Wight Cat.* n. 1780. Poa nutans, *Rottl.! in Neue Schriften*, IV. pp. 182 and 195. P. cernua, *Willd. l. c.* p. 182, in nota.

Eragrostis plumosa, *Link*, var. **riparia**, *Stapf.* Poa riparia, *Willd.* P. ciliaris? *Rottl.! in Neue Schriften*, IV. p. 185. Eragrostis ciliaris β., *Trinius.* E. riparia, *Steud.*

Eragrostis pilosa, *Beauv.* Poa indica, *Koenig ex Rottl. in Neue Schriften*, IV. p. 194.

Eragrostis major, *Host.* Poa polymorpha, *Koenig ex Rottl. in Neue Schriften*, IV. p. 194, probably belongs to this species; No. 3828 B. of Wallich's herbarium [Poa polymorpha, *Koen. Hb. Heyn.*] certainly does.

Eragrostis coromandelina, *Trin.* Poa coromandelina, *Koenig ex Rottl. in Neue Schriften*, IV. pp. 191 and 195. Poa bifaria, *Willd.* l. c. There are various specimens of this species at Kew from Rottler's herbarium, but not collected between September 24 and October 7.

CCCXCVI.—CULTIVATION OF VANILLA IN TAHITI.

Tahiti Vanilla was briefly noticed in *Kew Bulletin*, 1892, p. 214.

The following further information respecting the cultivation of Vanilla in the island of Tahiti has lately been published in a Foreign Office Report, prepared by Mr. Vice-Consul Brander, No. 319, Miscellaneous Series 1894 :—

"The cultivation of vanilla has been carried on in the island of Tahiti for several years, but is limited to a few districts only, that of Papara supplying more than half of the quantity sent into the market.

"*Mode of Culture.*—The native mode of culture is, as a rule, simply to plant the cuttings of the vine under the shade of trees, and then to leave them to grow and twine round supports as best they can. Occasionally attention is paid to keep the vines trained round the trees and to prevent them from attaining a greater height than 9 feet, so that during the inoculating season the flowers may be reached without difficulty.

"Shade, though not dense, is absolutely necessary during the growth of the vanilla vine to ensure a successful crop of beans. About one year from the time of planting the vine commences to flower, and the inoculation, which then takes place, must be carefully attended to; this is generally carried out by women and children whose light hands are best suited for the delicate operation. In from six to nine months from the time of inoculation the bean will be ripe for picking and curing.

"The native method of curing is to keep the beans alternately indoors rolled in cloths, and outdoors during the day spread on mats exposed to the sun, for periods of three or four days at a time, until they are dried and ready for the market. The disadvantage, by drying on mats in the open, of having beans frequently wetted and deteriorated in value by sudden showers before there is time to get them under cover, has made itself apparent to many native planters who now dry their vanilla in boxes with glass covers similar to those used at the Temarua plantation, in the district of Papara, which is under foreign management.

"In this plantation great attention is paid to trimming the plants, and keeping the ground clear from weeds; the vines are trained on well selected supports; and the process of inoculation is invariably carefully attended to. It may here be remarked that low prices in the market one season may render the native planter so indifferent to his interests that his plantations may be left entirely neglected the following year, the flowers even not being inoculated.

"These failings naturally tell to the advantage of the Temarua plantation, though from steady and good management its crops invariably command the highest prices in the market.

"*Curing.*—The boxes used for curing the beans are made of hard wood with glass covers, and measure 6′ × 4′ × 2′ in depth. They are usually filled three-quarters full, the beans being placed on a blanket in the bottom of each box and covered with a double thickness of blanket at the top. The glass lids are then put on, and the boxes exposed to the sun for about 15 days, when the beans are generally found to be sufficiently sweated to admit of their removal to the drying house.

"This building is constructed throughout of corrugated iron, and contains three tiers of wire shelves. The beans are laid on the top tier first, then they are moved to the second and third in succession as they gradually dry, and remain on the latter until they are perfectly dry and fit for the market.

"*Area and Cost of Cultivation.*—The Temarua plantation consists of 23 hectares, about 51 acres; 3 hectares of which have been newly planted, and will soon be bearing. The planting of these 3 hectares has cost the proprietor 105 dol., or 35 dol. per hectare, and when the crops are ready for picking they may be valued at 2,500 dol.

"*Expenses.*—The annual expenses of a plantation of this description, with an experienced foreman receiving 1,000 dol. per annum, amount to about 2,000 dol.

"*Crop.*—The crop varies from 100 kilos. to 200 kilos., and in some cases to 300 kilos. per hectare per annum; an average, therefore, of 150 kilos. would give the proprietor 3,450 kilos. per annum, and the average price being 2 dol. per kilo., he may calculate on a clear profit of 4,900 dol. The average this year has, however, fallen very much short of preceding seasons, owing to the continued rain.

"*Quality.*—The Tahiti vanilla is inferior to that of Mexico, Bourbon, and Mauritius, and this drawback is not improved by the careless manner in which the native, and even the European, dries and ties his bundles of beans for export.

"*Exports.*—The exports for the past 10 years has gradually increased, the United States being the principal market; small quantities are, however, from time to time sent to France and England.

TABLE showing the Export of Vanilla during the years 1883–92.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	Lbs.	£		Lbs.	£
1883 - -	2,726	818	1888 - -	12,569	5,028
1884 - - -	5,454	1,636	1889 - - -	8,789	1,758
1885 - -	4,919	1,475	1890 - -	15,882	3,248
1886 - -	8,408	2,522	1891 - -	24,585	7,456
1887 - -	7,610	3,044	1892 - -	25,560	4,418

In the United Consular Reports for February 1894, p. 265, the following additional information is furnished respecting Vanilla in Tahiti :—

"Vanilla beans have decreased greatly in value during the past two years, owing to the overstocking of the San Francisco market. During the month of December they enhanced slightly in value; but no marked improvement can be reported, and, in my opinion, none will be realized until the 15 tons of Tahitian vanilla in San Francisco are sold. America is the largest market for the Tahitian vanilla, and all grown on this island finds a market there, with perhaps the exception of about one ton, which is sent to other countries. This year there were exported to all countries 25,560 pounds of vanilla, valued at $28,599."

CCCXCVII.—VANILLA AT FIJI.

An account of vanilla cultivation at Tahiti is already given. It appears that in another group of the Polynesian Islands, now under British rule, the same cultivation has been introduced, and it bids fair to become thoroughly established. The infant industry owes much to the encouragement given to it by the praiseworthy efforts of the Governor, Sir John Bates Thurston, K.C.M.G. The successive steps taken in the matter are set forth in the following correspondence which has passed between the Colonial Office and this establishment :—

COLONIAL OFFICE to ROYAL GARDENS, KEW.

SIR, Downing Street, November 7, 1891.

I AM directed by Lord Knutsford to transmit to you a copy of a Despatch from the Governor of Fiji, forwarding a box stated to contain a sample of the last vanilla crop, and requesting an opinion on its value and observations as to the best mode of preparing it for the European market.

His Lordship would feel obliged if you would be good enough to meet Sir John Thurston's wishes in this respect.

I am, &c.

The Director, (Signed) R. H. MEADE.
Royal Gardens, Kew.

[Enclosure.]

Sir J. B. THURSTON to LORD KNUTSFORD.

(Fiji, No. 69.)
Government House, Suva, Fiji,
September 14, 1891.

MY LORD,

IN my Despatch, No. 15, of the 16th February 1891, upon the planting prospects of the Colony, I had the honour of adverting, paragraph 17, to the culture of vanilla, and expressed my intention of taking measures for curing, upon the most modern methods, such vanilla as might be grown by planters in this neighbourhood.

2. It affords me pleasure to state that since writing that Despatch, Mr. Leslie E. Brown, one of the leading residents of this port, has taken up the subject with much energy, and upon his own account built an oven for the purposes intended by me.

3. With the aid of an expert, who is a native of Mauritius, Mr. Brown has succeeded in curing the last year's crop in a manner which I can regard only as highly successful, though I do not doubt that with increased experience improvement may be looked for. The vines at present are only bearing their first crop, and I am given to understand that the first crop is never so fine as those which subsequently follow.

4. Your Lordship is perhaps aware that in a remote and young Colony, such as this, it greatly encourages planters to receive an authoritative expression of opinion as to the value of their products. I, therefore, take the liberty of transmitting with this Despatch a small box, which I have had carefully closed, containing an average sample of the last vanilla crop, and I should feel obliged if your Lordship would move the Kew authorities to favour me with an opinion upon its value, and with any observations as to the best mode of packing it for the European market.

I have, &c.
(Signed) JOHN B. THURSTON.

The Right Hon. the Secretary of State
for the Colonies.

ROYAL GARDENS, KEW, to COLONIAL OFFICE.

Royal Gardens, Kew,
November 16, 1891.

SIR,

I AM directed by Mr. W. T. Thiselton Dyer to acknowledge the receipt of your letter of the 7th instant, forwarding a copy of a Despatch from the Governor of Fiji on the subject of a sample of vanilla produced in that Colony.

2. The sample was duly received . . . and it was valued at 4*s*. to 5*s*. per pound. It is suggested that the beans should be shipped in a less dry condition, and softer and more fleshy in texture These and

other useful hints are given in the enclosed copies of report from Messrs. Burgoyne, Burbidges, & Co. . . .

I have, &c.

The Hon. R. H. Meade, C.B. (Signed) D. Morris.

[Enclosure 1.]

Messrs. Burgoyne, Burbidges, & Co., to Royal Gardens, Kew.

Dear Sir,

The sample of vanilla from Fiji is by far the best I have yet seen from that country, they are well cured and possess a good flavour for that class of bean; if they could, however, be grown more fleshy their appearance would be better and value greater. At the present time, these beans would fetch about 4*s.* 6*d.* to 5*s.* per lb. on this market; present supplies of vanilla are rather large, and values accordingly low.

I remain, &c.
(Signed) H. Arnold.

[Enclosure 2.]

Messrs. Burgoyne, Burbidges, & Co., to Royal Gardens, Kew.

Dear Sir,

With reference to the packing of the vanillas, the best way is to put them into tins holding from 15 to 20 lbs., let the corners of the tins only be soldered not all round, in order to prevent the formation of mould. The tins are then packed in cases,not tin lined, about 20 tins in each case. No paper or other wrapping is put round the beans, they are simply tied as your sample was, but the ends should be arranged more evenly than they were in your sample. At the present moment vanillas are low in value owing to the market being well supplied. The finest beans would be worth from 17*s.* 6*d.* to 20*s.* per lb., according to length and appearance. A good, well flavoured bean from 8 to 8½ inches in length would fetch about 17*s.* 6*d.*, whilst an extra superior bean of the same length, or measuring perhaps 9 inches, would fetch the higher figure.

I remain, &c.
(Signed) H. Arnold.

In a later account given in the Annual Report of the Governor (No. 97, Fiji, 1894), the following particulars are furnished respecting a sample of vanilla forwarded from Fiji to Melbourne. Messrs. Langton, Hicks, Bros. & Co., wholesale druggists, of Melbourne, report as follows:—

"In rendering you the account sales of your first consignment of Fijian vanillas, I must congratulate you on the prices realised, viz., 22*s.* 6*d.* per lb. for ¾ths of the consignment, and 21*s.* 6*d.* per lb. for the remaining ¼th. Unless the quality had been very satisfactory, no such prices would have been obtained; and, if future consignments are up to the quality now sent, I can see that Fijian vanillas will command a good price and a great sale. Speaking from an experience of nearly 40 years, during which time I have handled considerable quantities of vanillas, I unhesitatingly say the quality of what you have sent me is equal to any vanilla grown in the Mauritius or elsewhere. I have now before me the original sample you sent me to report upon. The beans are plump and well cured, and are beginning to throw out splendid crystals. In future consignments it will be necessary to sort the vanillas and tin them according to their lengths, and care should be taken not to pack the tins too closely."

An account of Vanilla cultivation with hints for fertilising the flowers and curing the pods was given in the *Kew Bulletin*, 1888, pp. 76–80 (with plate). The other references are as follows:—Note on collection of vanilla pods in the Kew Museum (No. II.), 1891, p. 277; Disease of Vanilla, Seychelles, 1892, pp. 111–120 (with plate); Vanillas of Commerce from Mexico, Bourbon, Mauritius, South America, and Tahiti, 1892, pp. 212–214; Vanilloes, an inferior sort of Vanilla, from Guadeloupe and Martinique, 1892, pp. 214–215; Vanilla in British Honduras, 1893, p. 327.

CCCXCVIII.—FLORA OF THE SOLOMON ISLANDS.

Within the last decade Kew has received in the aggregate a considerable number of dried plants from this group of islands, including some highly curious novelties, some of the more striking of which have been published.* These were collected by Mr. H. B. Guppy and the Rev. R. B. Comins. In April of the present year a small collection was received from the same islands, made by the officers of H.M.S. "Penguin," and communicated by Captain W. G. L. Wharton, F.R.S., Hydrographer to the Admiralty. Some of the specimens were spoilt by excessive dampness; many were of the common seaside plants of Malaya and Polynesia, but there is a residue of sufficient interest to put on record, including a few previously undescribed species.

SAPINDACEÆ.

Allophylus littoralis, *Blume* (Schmidelia littoralis, *Bl.*).—Malay Archipelago and New Guinea. This is probably a variety of the widely-spread and variable *A. Cobbe*, Blume. Mr. Guppy also collected it in the Solomon Islands, where it occurs in the coast region.

MYRTACEÆ.

Barringtonia racemosa, *Blume*.—This very handsome tree is widely spread, ranging through Eastern India, Malaya, and Western Polynesia to New Caledonia, but this, we believe, is the first record of it from the Solomon Islands.

MELASTOMACEÆ.

Medinilla Mortonii, *Hemsl.* n. sp.

M. heterophyllæ proxime accedens, differt imprimis novellis hirsutis, foliis tenuioribus opacis, inflorescentiæ axillaris bracteolis majoribus.

Frutex scandens (fide *Guppy* et *Comins*), probabiliter epiphyticus, ramulis floriferis crassiusculis pravis. *Folia* valde disparia, vel uno omnino deficienti pseudoalterna, tenuia, fere membranacea, primum parcissime furfuraceo-hirsuta, minora sessilia vel subsessilia, rotundato-cordata, amplexicaulia, majora distincte petiolata, usque 9–12 poll. longa, acute acuminata, basi cuneata vel subcordata, 7-plinervia. *Racemi* axillares, pauciflori, 2–4 poll. longi, dense furfuraceo-hirsuti; bracteæ cordato-oblongæ vel oblongæ, pedicellos æquantes. *Flores* rosei, oppositi, pedicellati, pedicellis circiter semipollicaribus; bracteolæ petaloideæ, albæ, ovoideæ vel ellipticæ, fere pollicares, juxta flores sessiles, et per paria flores solitarios includentes; calyx truncatus, dense furfuraceo-hirsutus, circiter 2 lineas longus; petala oblonga, circiter semipollicares; antheræ postice longe 1-calcaratæ. *Bacca* globosa, seminibus numerosissimis.

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* *Annals of Botany*, Vols. v. and vi. and Hooker's *Icones Plantarum*, Series 4, Vol. iii.

Fragments of what I take to be the same species as this were collected in the Solomon Islands both by the Rev. R. B. Comins and Mr. H. B. Guppy; but the description has been drawn up entirely from a specimen collected by the officers of H.M.S. "Penguin," except the reference to the habit and the colour of the flowers.

This plant is named after Mr. J. E. V. Morton, Paymaster, R.N., who collected most of the plants herein enumerated.

CUCURBITACEÆ.

Benincasa cerifera, Savi.—We previously possessed unnamed specimens of this from Samoa; and Seemann collected it in the Fijis, though he did not identify it. It is the *Cucurbita pruriens*, Solander; and it has a wide range in tropical and sub-tropical Asia and Polynesia, extending eastward to the Marquesas.

RUBIACEÆ.

Uncaria ferrea, *DC.* (Nauclea ferrea, *Blume;* Uncaria appendiculata, *Benth.*).—This is an eastward extension for this plant, which is common in the Malay Peninsula and Archipelago, and is also found in New Guinea and Australia. It has been alternately placed in *Nauclea* and *Uncaria;* and it has the decidedly imbricate petals and sessile flowers of the former genus, the pedicels developing in the fruiting stage.

Bikkia gaudichaudiana, *Ad. Brongn.* in Bull. Soc. Bot. de France, xiii. p. 43, ex descriptione.—Brongniart records this species from Triton Bay, South-west New Guinea; Waigioe Island, off the north-west point of New Guinea; and Tahiti; and, assuming the determination to be correct, there are specimens in the Kew Herbarium from Tubuai Island, collected by Barclay, as well as from the Solomon Islands.

Brongniart describes several species of *Bikkia* in the place cited, including one from the Marianne Islands; but Drake del Castillo (*Flore de la Polynésie Française*) and other writers on the Flora of Polynesia have overlooked them. *Bikkia grandiflora*, Reinw., has been collected in the Solomon Islands by several persons.

Randia coffeoides, *Benth. et Hook. f.* (*Stylocoryne coffeoides*, A. Gray).—The Solomon Islands specimen agrees exactly with specimens from Tahiti (Wilkes); but the Friendly Island specimens so named look somewhat different, and have dried quite a different colour.

Ophiorrhiza rupestris, *Hemsl.* **n. sp.**

Species ex affinitate *O. Mungo* sed minor foliis ovalibus obtusis vel rotundatis, etc.

Herba vel suffrutex plus minusve puberulus, 6–12 poll. altus, simplex vel ramosus. *Folia* breviter petiolata, tenuia, fere membranacea, ovalia vel lanceolato-oblonga, cum petiolo usque ad 3½ poll. longa, apice rotundata vel obtusa, vel si subacuta nunquam acuminata, basi cuneata vel interdum fere rotundata, subtus pallidiora, venis primariis lateralibus utrinque circiter 6–10 subtus sat conspiciuis; stipulæ minutissimæ vel obsoletæ. *Cymæ* terminales, pauciramosæ, breviter pedunculatæ, quam folia multo breviores, ebracteatæ, ebracteolatæ. *Flores* albi (*Comins*), subsessiles, fere glabri, vix 3 lineas longi, calycis dentes minuti, ovati, obtusi; corollæ lobi oblongi, obtusi, tubum subæquantes, fauce longe villoso-barbata; stamina styloque breviter exserta. *Capsula* circiter 3 lineas lata, glabra.

This was also collected by the Rev. R. B. Comins, who localised it as found on rocks by the seashore.

COMPOSITÆ.

Blumea Balfourii, *Hemsl.*, n. sp.

B. Milnei similis sed capitulis paucioribus subduplo majoribus, involucri bracteis numerosioribus exterioribus latioribus crassioribus, achæniis distincte striatis minus hirsutis, pappo albido.

It is very difficult to define the limits of the species of *Blumea*, and the investigation of living plants might lead to combining this with *B. Milnei*, Seem. (Bot. Voy. "Herald," p. 141, t. 27), for they are very much alike in foliage. The name of Commander A. F. Balfour, R.N., is associated with this plant in recognition of the facilities he afforded for making a botanical collection in the Solomon Islands.

ASCLEPIADEÆ.

Hoya inconspicua, *Hemsl.*, n. sp.

Species foliis anguste lanceolatis floribus inter minores propria.

Scandens, parasitica, undique glabra, ramis graciliusculis. *Folia* primaria ramorum floriferorum sæpe ad filamentos radiciformes reducta; folia ramulorum secundorum valde abbreviatorum ex axillis (?) filamentorum erumpentia sæpius geminata, id est ad parem unicum reducta, breviter petiolata, crasse coriacea vel subcarnosa, anguste lanceolata, cum petiolo usque ad 4 poll. longa, sed sæpius breviora, utriuque attenuata, subacuta, venis omnino immersis; petiolus circiter 3 lineas longus, sæpe tortus. *Umbellæ* pauciflorae, pedunculatæ, pedicellis gracilibus 4–6 lineas longis. *Flores* circiter 4–5 lineas diametro; calycis segmenta minuta, ovata, obtusa; corollæ lobi ovati, acuti, apice recurvi, intus, ut videtur, rugulosi; coronæ segmenata inflata sursum acuminata deorsum bifida vel breviter biloba lobis subobtusis. *Follicula* ignota.

This was also collected by Mr. H. B. Guppy.

The leaves of the primary branches appear to be often, yet not always, reduced to filiform organs resembling small aerial rootlets, from the axils (?) of which proceed very short secondary branches bearing a single pair of leaves; but the exact nature of their development cannot be determined from the imperfect specimens we possess.

CYRTANDREÆ.

Boea Commersonii, R. Br.—This is recorded from several localities in the New Britain Archipelago, from North Australia, and from Java; but Kew previously possessed only one specimen, and that is also from the Solomon Islands.

Epithema, species nova.—Although there is no doubt concerning the affinity of this plant, the flowers are too rotten for description.

ACANTHACEÆ.

Eranthemum whartonianum, *Hemsl.*, n.sp.

E. variabili similis sed majus floribus multo majoribus corolla glabra.

Herba perennis vel suffrutex 1–2 ped. altus, plus minusve puberulus, ramulis graciliusculis. *Folia* distincte petiolata, tenuia, fere membranacea, ovato-oblonga vel superiora interdum anguste lanceolata, 2½–5 poll. longa, obtusa, nunc leviter acuminata, nunc fere rotundata, basi cuneata vel interdum fere rotundata, supra minutissime strigosa, subtus præcipue in venis puberula; petiolus gracilis, circiter semipollicaris. *Flores* albi (*Guppy*), 1–1½ poll. longi, spicato-racemosi, spicis terminalibus, inferiores cymosi, cymis 2–3 floris distincte pedunculatis, superiores in axillis bractearum subulatarum breviter pedicellati vel subsessiles, supremi interdum solitarii. *Calycis* puberuli vel subglabri segmenta subulata, 1½–2½ lineas longa. *Corollæ* tubus rectus, cylindricus, angustus, apice leviter ventricosus; limbus circiter 9 lineas diametro, obliquus, antice magis productus, segmenta patentia, leviter inæqualia, ovali-oblonga, apice obtusissima vel rotundata; genitalia brevissime exserta. *Capsula* glabra, clavata, circiter pollicaris, supra medium tantum seminifera, 4-sperma, deorsum attenuata, apice stylo indurato coronata; semina pallida, valde compressa, rotundata, insigniter alte rugosa.

This was also collected by Mr. H. B. Guppy, both in Treasury and Shortlands Islands; and there is a small cultivated specimen in the Kew Herbarium communicated by Messrs. Veitch, of Chelsea, who reported having received it from the Solomon Islands.

Captain W. J. L. Wharton, F.R.S., Hydrographer to the Admiralty, has done so much to encourage botanical collecting by naval officers, especially in the Pacific Islands, that we have much pleasure in connecting his name with one of the new species.

Eranthemum pacificum, *Engler*, Jahrb. vii. p. 475.—Kew previously possessed this plant from the island of Guadalcanar (Milne, 544; Veitch); San Christoval, (Milne, 477); Purdie Islands (Hollrung); and Dr. Engler, in the place cited, refers specimens from the New Hebrides (Moseley), and New Caledonia (Lenormand), which we do not feel so sure about, to this species. He also refers here the plant sent out in 1878 by Mr. William Bull, under the name of *Eranthemum nigrescens*. Perhaps correctly, but the venation of the leaves looks very different. *E. nigrum*, Linden (Ill. Hort. n.s. t. 404) is probably the same as the latter, and is also recorded from the Solomon Islands.

PIPERACEÆ.

Piperis species duæ indeterminatæ.—Both of these are plants of an ornamental character, but only sterile branches were collected. The one has cordate, variegated leaves, and the other has broadly ovate, acuminate, peltate leaves of a uniform green.

MYRISTICACEÆ.

Myristica hypargyrea, *A. Gray.*—A handsome species previously known from the Fiji and Friendly Islands.

EUPHORBIACEÆ.

Phyllanthus.—A very large-leaved species, of which, however, only male flowers were collected.

URTICACEÆ.

Ficus species duæ indeterminatæ.—Only the climbing sterile condition. One of them is very much like the familiar *F. stipulata*, but much smaller.

Elatostemma.—This is a very distinct apparently undescribed species, but the material is too rotten to permit of a satisfactory description being drawn up. The Rev. R. B. Comins collected the same species in the Solomon Islands, and the specimens are in much the same condition.

ORCHIDEÆ.

Dendrobium lineale, *Rolfe.*—Also collected by Mr. Guppy, and there are cultivated specimens in the Herbarium recorded from New Guinea. It is exceedingly near *D. veratrifolium*, Lindl., and possibly only a colour variation. It inhabits the same countries.

Dendrobium Goldfinchii, *F. Muell.* in *King's Southern Science Record*, January 1883, ex descriptione.—The same species was collected in the Admiralty Islands by the late Professor Moseley, on the voyage of the "Challenger," and both Mr. Guppy and the Rev. R. B. Comins had previously collected it in the Solomon Islands. Sir F. Mueller gives no dimensions, and his description is in other respects not quite sufficient to arrive at certainty with regard to the identity.

Dendrobium hispidium, *Rich.* ?—Also found in the New Hebrides and Eastern Australia.

Bolbophyllum, sp. nov. ?—It would require too great an expenditure of time to determine whether this is one of the very numerous described species of this genus not represented by authenticated specimens in the Kew Herbarium.

Grammatophyllum.—Detached flowers only of a marked species. Similar specimens from Mr. Guppy.

Spathoglottis Vieillardii, *Reichb.* f.—New Caledonia, New Hebrides, Solomon Islands, and Banda.

CCCXCIX.—METHODS FOR EXTERMINATING LOCUSTS IN THE CAUCASUS.

The following interesting correspondence is published for general information:—

FOREIGN OFFICE to ROYAL GARDENS, KEW.

Foreign Office, June 15th, 1894.

SIR,

I AM directed by the Secretary of State for Foreign Affairs to transmit to you the accompanying copy of a despatch from Her Majesty's Consul at Batoum, respecting the best methods for exterminating locusts and other harmful insects.

I am, &c.
(Signed) E. GREY.

The Director,
Royal Gardens, Kew.

British Consulate, Batoum,
June 6th, 1894.

My Lord,

In view of the importance generally attached in agricultural circles to the question of the destruction of locusts and other harmful insects, such as field cockroaches and grasshoppers, I have the honour to here below, give a summary of certain recommendations that have recently been issued by the Russian Ministry of Agriculture, for the information of agriculturists, indicating the measures which, in the opinion of competent authorities, are best suited for the extermination of such insects.

Many districts of the Caucasus suffer most severely from the ravages annually committed by these enemies of the cultivator, and it is hoped that the information contained in the document which is now issued will materially assist the agricultural classes in the infested districts to more effectually contend against the scourge.

The instructions minutely set forth all the distinguishing marks of the above-mentioned insects, and the Ministry recommends the adoption of the following methods for their destruction in the localities whence they originate, viz., (1) by means of burning, (2) by driving into trenches, (3) by crushing with wattled hurdles or stone rollers, and by catching the insects in bag-nets.

In places where deposits of locusts are discovered as early as the autumn, it is recommended that during that season, sufficient quantities of straw, when available, as well as weeds growing on the fields and steppes, be collected in readiness for use. Towards evening, the insects are in the habit of gathering in thick swarms, and remain thus crowded together almost without moving until sunrise. When the insects are only a few days old, they are especially disposed to agglomerate in compact swarms, the straw and weeds must then be spread about, the insects will eagerly crawl on to them during the night, and just before sunrise, they should be set alight on different sides.

This mode of procedure is extremely simple and far more practical than the system previously adopted by ploughing in the grubs of the locusts.

The second method recommended by the ministry, viz., driving into trenches, necessitates more labour, and is effected in the following manner:—

Trenches, one foot nine inches wide by two feet four inches deep, must be dug at a distance of ten paces from each swarm of locusts, into these the locusts have to be driven and the trenches then filled up with earth. The fact that the locusts invariably congregate in large swarms and move in one general direction considerably facilitates the driving process. Detailed instructions, illustrated by diagrams, for digging the trenches are embodied in the recommendations issued.

The third method, viz., crushing with wattled hurdles, is recommended for adoption on hard soil and in dry weather, in localities where woods and bushes are plentiful. Strong wooden frames seven feet long by three and a half feet wide, made by nailing together four stout poles, should be used for making the hurdles, and the lower part of the hurdle, *i.e.*, that part nearest the ground, should be closely wattled with stiff and twiggy branches of ivy, &c., the leafy ends of which must extend behind the frame somewhat in the shape of a wide broom; in order to increase the weight of the hurdle, stones or sacks of earth should be placed on the frames; these hurdles must be dragged over the ground on which the young and still wingless locusts are swarming, and by these means they will be effectually destroyed. In places where no woods exist and the ground is hard, it is recommended to employ stone rollers for crushing the locusts, and finally their destruction by catching them in bag-nets is also recommended.

In the opinion of the ministry, these measures are the most practical of all those hitherto employed.

The Earl of Kimberly, K.G., &c. &c. &c.

I have, &c.
(Signed) P. STEVENS.

CCCC.—PRESERVATION OF BOOKS IN THE TROPICS.

The care of any considerable collection of books in a warm country is a much more difficult matter than in a cool one. The following summary of information on the subject is extracted for general information in the Colonies from *India Museum Notes*, vol. iii., No. 3 (1894).

The preservation of Books from Insects in India.

In April 1893 information was called for upon the subject of the destruction of books by insects in Calcutta, and as the matter is one of general interest it may be useful to notice what was ascertained. The most troublesome insect in Calcutta libraries appears to be a minute Ptinid beetle, which agrees with the description of the species *Sitodrepa panicea*, Linn. This cosmopolitan book-maggot drills pin-holes through and through the cover and body of a book, and often completely disintegrates it. The only other insects which have been noticed as causing any considerable damage are white ants (*Termes sp.*) and cockroaches (*Periplaneta americana*, Deg.). The first devours the books wholesale, but are easily prevented from gaining access to them by placing the shelves upon the stone insulators commonly in use, while the second merely deface the bindings, so are of less importance.

The treatment recommended for use in the library of the Revenue and Agricultural Department was that of disinfecting the books by pouring a few teaspoonfuls of refined mineral naphtha, or what is known as benzine collas, into the crevices of the binding, and then shutting up the volume for a few days in a close-fitting box to prevent the escape of the fumes. Books so dealt with to be afterwards sponged over lightly with a very little of the finest kerosine oil, which should be rubbed off with a cloth before it has time to penetrate into the binding. This renders the books to a great extent distasteful to insects without causing serious injury. It is objectionable on account of the odour of the kerosine oil, but has the recommendation of harmlessness combined with considerable efficiency.

Particulars have since been obtained, through the kindness of the Superintendent of the Royal Botanical Gardens, Sibpore, of a system which has been adopted for preserving books in that institution. The treatment has been in use for a number of years, apparently without accident, and Dr. George King reports very favourably upon its effects. It consists in brushing the books over with a saturated solution of corrosive sublimate, made by constantly keeping a few lumps of the poison at the bottom of the jar of alcohol (presumably the ordinary methylated article which has a strength of about 70 or 80 per cent.), so that the maximum amount may be absorbed. Great care should, of course, be taken in handling the corrosive sublimate on account of its exceedingly poisonous nature.

It may be useful to add that in the Indian Museum Library, where the books are kept in close-fitting glass cases, with a few ounces of naphthaline upon each shelf, little or no damage is caused by insects. From a note furnished by Mr. R. Chapman, late librarian, it appears that the paste used in binding the Indian Museum books is poisoned by adding about half an ounce of sulphate of copper to each lb. of paste, while books already infested are disinfected by shutting them up for four or five days in a close-fitting box of loose naphthaline with as much of this substance as possible between the leaves.

CCCCI.—TABLE OILS FROM BEECH AND LINDEN.

A fine sample of oil obtained from beech nuts (*Fagus sylvatica*, L.) was presented to the Kew Museum by the late Dr. Seemann in 1854. This sample is still in existence and is of a bright yellow colour, very closely resembling the finest olive oil. In works on botany a reference is generally made to the fact that "the fruits of the beech yield oil," but in this country at least no attempt has been made to prepare the oil in quantity. Dr. Seemann's specimen was obtained from northern Germany, where also the refuse of the nuts is used for fuel. An effort is now being made to develop the production of oil also from the lime or linden tree (*Tilia europæa*, L.). The particulars are contained in a report prepared by Mr. Alfred C. Johnson, the U.S. Consul at Stuttgart, and published in December last:—

New Table Oils in Germany.

On account of the great expense and difficulty in procuring pure olive oil for table purposes, there have been many attempts made in Germany to produce from other substances than the olive an oil which, having all the qualities that recommend the olive oil, could be sold at a lower price.

In southern Germany for some years past oil has been produced from the beech nut. It has given great satisfaction, but has not come into general use because the production has been small and the oil has never been pushed on the market. One reason why more has not been done in the production of this beech-nut oil has been the great scarcity of the nut in certain years.

The beech nut contains but 22·77 per cent. of oil, but when the nuts are plentiful, the ease with which they can be gathered, the fact that there is absolutely no other expense except the pressing, and the good prices that have been received for the oil have made the production of the oil very profitable.

It is only of late that the seeds of the linden tree have been used for the production of oil. According to the report of Dr. C. Müller to the German Botanical Society, this oil has a number of excellent qualities, which would appear to make it certain that the linden seed will hereafter be considered one of the principal sources for obtaining table oil. The linden tree is a regular bearer, so that a large quantity of seed may be counted upon each autumn. The per-centage of oil in the linden seed is given at 58. It is maintained that the oil has a peculiarly fine flavour, free from all bitter or aromatic taste, and that it has the appearance of olive oil. It belongs also to the oils which do not evaporate.

Oil made from linden seed will never become rancid. It has no tendency to oxygenate. It will stand a great degree of cold without freezing. Dr. Müller has exposed it to 3° F. below zero without being able to notice any change.

(Signed) Alfred C. Johnson,
Consul.

Stuttgart, September 29, 1893.

CCCCII.—CULTIVATION OF VEGETABLES.

The following interesting article is reprinted from the "Standard" of September 16th, 1893. As a useful and, doubtless, correct summary of the facts it deserves more permanent preservation than is to be found in the columns of a daily newspaper. The moral has even more than a two-edged significance. Early vegetables are a luxury of the rich. They can always be produced in lower latitudes for consumption in higher. The enhanced cost principally represents the difficulty and distance of transport for perishable commodities. Just as the shores of the Mediterranean and the Atlantic islands can supply Northern Europe, so the West Indies can, in great measure, supply the great consuming communities of North America.

This is one question. The other is the extension of intensive cultivation within the British Isles. It is in vain that England has brought the cultivation of wheat to a point which yields the greatest production per acre of any country in the world (see *Kew Bulletin, infra*, p. 167). It is more than three times that of India and double to three times that of the United States of America. But under the conditions of competition it will not pay. If, however, it pays to import cabbages from Holland, the conditions of competition are sufficiently similar to make it probable that they might be grown at a profit in England. And the argument may be extended to other vegetables.

Even in the British Isles the cultivation of early vegetables is a profitable industry south of the 52° isotherm, beyond which lies extreme south-west Cornwall, the Scilly, and the Channel Islands. A correspondence has taken place with the Irish Land Commission as to the possibility of extending the industry to south-west Ireland, the coast of which also lies south of the 52° isotherm.

The Importation of Vegetables.

The tourist on the homeward-bound packet crossing the North Sea, the Channel, or hailing from the Mediterranean, cannot fail to notice that vegetables form a great part of the freight. On the quays of our north-eastern and southern ports, crates upon crates are always to be seen heaped up, only to be speedily taken away by the attendant row of railway trucks. Again, on walking through the poorer neighbourhoods of London, or any of the large provincial towns, the quantity and good quality of vegetables displayed on costers' stalls must at once attract attention. Tomatoes, a comparatively newly-acquired taste, are to be had for a few pence per pound, and cauliflowers can be purchased at one-third of the price they fetched a dozen years ago. Moreover, a distinct luxury, once enjoyed only by the very well-to-do, appears in fair quantity. Both last and this year, in all probability for the first time, asparagus has been sold largely on the street stalls. What is more important for every-day wants, is the profusion of potatoes, which find ready purchasers. The question naturally arises, whence comes this constant and seemingly unlimited supply? Is it wholly of home, or partly of foreign production? It is, indeed, well worth the answering. Take, as an instance, to begin with—potatoes. In the middle of May, this year, in the streets, and in the poorest classes of shops, new potatoes were offered for sale. If anyone 10 years ago had stated that the labourer's wife would be able to purchase such a luxury with her few pence, and yet be buying what she could reasonably afford, it would have been reckoned an utter absurdity. Nowadays it is an undoubted fact. The round new potatoes in question come from the Mediterranean. From the end of January to Easter, Malta supplies us with these new spring vegetables. This importation, however, seldom lasts beyond the middle of May; still, while it does, it comes over in considerable bulk. Of the best-class Maltese rounds and kidneys over 800 or 900 casks, cases, and boxes have been sold at one auction rostrum in one of the best markets in less than a week. At what might be termed the second-rate markets much the same has been the case. These new potatoes, it must be owned, cannot hold their own against those of Jersey, the skins becoming hard and not able to be scraped, owing to the sweating caused by the long voyage in case. Following the first Maltese supply comes that of Maderia and the Canary Isles. This, be it said, is of far better quality, as is the case with all vegetables hailing from the Canary Islands. But the pick of the early new spring potatoes is undoubtedly that which arrives, *viâ* Paris, from Algeria. In the month of June, from Jersey, are seen in market both rounds and kidneys, in every way equal in quality to those which are grown in the home country. But the short transit must not be forgotten. A cask from Jersey could be easily opened in London within 24 hours. So much for the early foreign importation hailing direct from the Mediterranean (even occasionally from Lisbon, although of somewhat poor quality), and, not over frequently, *viâ* Calais, and even at times from Havre. As to old potatoes—from Holland, *viâ* Rotterdam—all the eastern ports and the Thames are constantly furnished with somewhat inferior produce, grown mostly in the neighbourhood of Haarlem. In September come to hand the excellent Belgian kidneys, in many respects the very best in the market, mealy, dry, sweet, and clean. These are brought from Western Flanders, *viâ* the Port of Antwerp. Indeed, in the vast district around Oudenarde, the campaigning ground of 1708, a well-dressed tourist can hardly make his appearance in any modest village or hamlet without being welcomed as a possible great crop buyer, for potatoes, be it known, are bought up by the field. As to the winter importation proper, tons upon tons become the property of English buyers, to whom they are consigned from the port of Hamburg. The German redskin holds a high place in the market, and even continues to do so late into April, always provided the weather be not too warm.

With regard to onions, England appears to be wholly dependent upon the stupendous foreign importation. Thousands of tons sometimes form the consignments in one week to the ports of London, Goole, Grimsby, Hull, West Hartlepool, and the minor ports of the east coast. At the London auction the totals of 50 kilo bags often mount at one sale to 150 tons, provided prices be fairly good. The supply is as absolutely unlimited as the demand. Onions are grown in every part of Germany, from the Baltic to the Danube, many bags even being the produce of Hungary. As to Spanish onions the supply is rapidly increasing, and the price rapidly falling. Cases which not many years ago fetched 14*s.*, 16*s.*, 18*s.*, and 21*s.* are now a days bought in the market as low as from 5*s.* to 8*s.* From Western Flanders, *viâ* Ostend, the freights of the savoury root are small compared to those bags which are brought *viâ* Antwerp, Rotterdam, and Hamburg. The earliest spring produce, as may be expected, comes *viâ* Paris, from the Riviera.

Foreign cabbages are not much valued in our high-class markets. Yet it must be owned that the poor would be badly off indeed for this healthy vegetable if they relied only on the English growth, which, at the earliest seasons of the year, would be quite beyond the reach of their purses. The cabbages sold at the Borough Market, at Spitalfields, and along the wharves, are, in almost all cases, imported from Holland. Of course, as to whether there is sufficient return given for the difference in price between the home growth and the foreign importation, there is much discussion. The retail dealer knows, however, that a cabbage is always a cabbage, and if it be fairly sweet, there is not much to be complained of. The red pickling cabbages find their way to our ports during the month of August, in large quantities, from Holland, *viâ* Rotterdam, as also does the bulk of the beetroot supply. Cauliflowers (the coarser qualities), later in the year are brought over from Holland, the choicest of the early market being of French growth. But both Dutch and French, as the season advances, are driven out by the produce of our southern counties and parts of Essex. The great popularity of the cauliflower in the market is due to its rapid growth, a good crop being easily obtained three months after planting out—say, from the beginning of April to the end of June. Imported brocoli, owing to its hardiness and much slower growth, keeps for many months on the market, though never realising great sales.

Celery, which is now more than ever in demand, as can be easily seen by the enormous quantities offered for sale on the street stalls, is, in almost all cases, of home growth. Indeed, it is on record that, at odd times, fairly large quantities have been exported to Paris itself, our greatest rival in the vegetable market. But of all the vegetable trades, the tomato has, undoubtedly, made the longest strides—a curious exception to the conservative taste of the English poor. Fifteen to 20 years ago working folk had a positive aversion to the rosy love-apple, and yet now, cut up raw with onions and eaten with bread and cheese or cold meat, it has become a common favourite of the poor. Five or six thousand cases of the middling class vegetable (it is not regarded as fruit in the market) have been knocked down by auction at one rostrum in a few hours. It may be fairly stated that 10,000 cases are now sold as against the 100 cases of 20 years or so back. As to the French tomatos, they are mostly grown in the Bordeaux district, coming to the English ports by sea, *viâ* Bordeaux and Charente. The better class, the next best to the English, are reared in Madeira and the Canary Islands. Recently there has been an attempt to import them from the Cape, but it has not met with very great success. Although kept in cool chambers the tomatoes were more or less damaged by the sea voyage, and unfit for the market. The freight charges, also, of the Cape steamers are, unfortunately, too high. For cool chambers the quoted price of freight is, on the average, 80*s.* per ton as ordinary cargo, or on deck 35*s.* or 40*s.* Still it must be owned that owing to the caterpillar scourge of this season the Cape tomatoes have really not had a fair chance of holding their own.

In the early part of the year the high-priced endive finds its way into the English market, *viâ* Paris, from Algeria. That asparagus may be bought on the street stalls by the poor of London is to be accounted for by the fact that the enormous supply which constantly arrives from the Riviera and the south of France generally, and is possibly what might be called market overflow; still, at the same time, it is a proof of the power of production. The cheap French article is the produce of the districts of Toulouse, Argenteuil, Dijon, and Perpignan. The Spanish asparagus seldom arrives in large consignments, never coming direct; in all cases it is purchased from the Paris dealers. The bundles have to be packed in open crates or cages, the dainty vegetable absolutely requiring a fresh and sweet air to prevent its fouling and becoming useless for good market purposes. And the French have reduced packing to a fine art. A most important consideration it is, for if the work be slovenly, without due care being bestowed on it, the goods are sure to be destroyed. Good packing is almost as important as good produce. The so-called French beans which are to be bought in Covent Garden from Christmas until June are almost always Algerian, though some hail from Madeira. The Cape also has been making an effort to supply the London market, not, however, with any great show of success. It is a question of quality. The French kidney beans, which arrive *viâ* Newhaven, must be owned to be the best. The distance from the Cape and the cost of freight, for the present at least, prevent any chance of successful competition. Early lettuces also are brought across Channel, the first consignments arriving about the beginning of May. These are followed up by the crops of the Channel Islands, Jersey, and Guernsey, which have to make way for English produce, as a rule, about the middle of June. Spinach, again, arrives both late and early from the Riviera, and is constantly competing with the English produce. Horse radish, to a great extent, reaches us *viâ* Hamburg, packed in bundles, which are again packed in hogsheads. The demand for this vegetable is much on the increase, anything that is sharp, savoury, or biting to the tongue being more and more popular with the poor. Garlic, as might not be expected, is sold in considerable bulk in Covent Garden Market; 10 tons have been put up for auction in a single morning, the strong-smelling bulb beginning to arrive about the second week in August, in sacks holding from 1 cwt. to 1¾ cwts., and coming mainly from Italy, the south of France, and from Spain. Later in the season the principal supply of shallots is of Dutch importation, though the first early lots mostly come from the Riviera.

It may be safely said, then, that all out-of-season vegetables—lettuce, cauliflower, spinach—are of French exportation, arriving, *viâ* Paris, from Africa. How is it, then, that we have no direct communication with African growers? The reason is that the French guard, or think they do, the interests of their colony with the utmost jealousy, and do their utmost to prevent us coming in mercantile touch with it. The choicest luxuries of the market are, of course, French-Algerian. Even the Russians buy direct from Paris, and every day are ready to give higher prices than can be afforded by our own dealers. Take, for instance, mushrooms, at least those intended for table use. They are distinctly Parisian specialities, the coarser sorts used for pickling and sauce being grown elsewhere. Throughout the Riviera the mushroom growers make a splendid harvest. And the delicate small turnips and carrots, which during the last two or three seasons have so often formed part of our most tasty *entrées*, are French likewise. For some reason or other, the French undoubtedly beat us in delicate production. Our

English gardeners might conceivably produce similar light, stringless, sweet, yet mild vegetables; but whether they can or cannot, they do not do so, or, at least, they are not much to be seen in the London market. Of course, the soil of Algeria is peculiarly favourable to the rearing of delicate root crops. Even the winter radishes that are brought from there have an exquisite flavour, which is never surpassed by our own growth.

Walking through the great vegetable markets, it is impossible not to admit that the best vegetables of all grades are of foreign importation. The strong, rank cabbage comes from Holland, yet so does the big white asparagus; the fairly good potato hails from Western Flanders, but Flanders can also boast a growth of the most delicate greenstuff. If farming failed here at home, surely market gardening of a rough kind might be made profitable. Even if our countrymen have not the requisite skill and application, or the habitual carefulness of the high-class Continental growers and their workpeople, they might well take up the rearing of the rougher class of vegetables. But as regards delicate productions, high-class English cut flowers can hold their own against foreign importations. Why not, then, English vegetables? Tomato growing has been found to pay; in fact, the English tomato reared under glass is far indeed from being a failure. As has been said before, the tomato has become a singularly popular food with all classes throughout the country. As to mushrooms, one or two very small mushroom farms have been started, just beyond the north-western London suburbs, with hardly any capital at all. Yet they are honestly flourishing. Why should they not find imitators? In almost every other trade we are able to make up the loss caused by the importation of cheap goods by the exportation of high-class ones. If we buy cheap German cutlery, we sell most expensive English. The same with glass, napery, and hosiery. It has been argued that we have to fight against better climates; but this the dealer tells you is not the case. The French may be a month ahead of us; still, we might hurry on our crops to better advantage than we do. The English production is but a small item in the market. The English farmer grumbles; yet he fails to become a market gardener either from lack of business enterprise, or from ignorance of how to make it pay. The vegetable market is by no means creditable to the average English agriculturist. The greengrocer's stock is 10 times as heavy as it was 20 years ago, yet for almost everything that is in it the dealer he purchases from looks to the Continent for his supply.

CCCC III.—PRODUCTION OF PURE TURNIP SEED.

The following correspondence raises a question of considerable practical importance. It is published for general information.

Board of Agriculture to Royal Gardens, Kew.

Board of Agriculture,
4, Whitehall Place, London, S.W.,
June 19, 1894.

Sir,

I am directed by the Board of Agriculture to transmit to you a copy of a letter addressed to this Department, and to state that the

Board would be glad to be favoured with any observations you may be able to offer on the subject referred to by Mr. Baillie.

I am, &c.
(Signed) T. H. Elliott,
Secretary.

The Director,
Royal Gardens, Kew, S.W.

(Enclosure.)

(*Copy.*)

Woodbine, Upton Park, Chester,
June 4, 1894.

Sir,

I am not sure that I am right in addressing myself to your Department upon the particular subject upon which I am about to write, but if not perhaps you would kindly say to what authority I might best apply or refer me to some reliable printed statement bearing upon the matter.

I want some information to confirm or correct impressions of my own upon the question of hybridisation or cross fertilisation. The question may be briefly stated thus. Where Swedish turnips have been planted out to stand for seed crop, will they be "stained" if a crop of, say common yellow turnip (not swedes) was allowed also to stand for seed (and therefore in bloom at the same time as the swedes are) growing upon land contiguous to the surface? It used to be a belief that swedes standing for "seed" should be isolated and separated from other *Brassicas* (all of which are in flower at the same time) to secure purity of type. *Now* in some of the swede growing districts I notice swede standing *next* to a piece of cabbage, then a field, say of common turnips, then say swede again, in consecutive and adjoining fields and all in full flower at the same period.

On questioning the seed farmer, he tells me recent theories seemed to be advanced that swede and common turnip separated by a piece of cabbage, brussels sprouts, or other *Brassica* of the cabbage type, were perfectly safe and would not be hybridised.

If you would kindly give me your reply or refer me to some standard of recent authority or printed report upon this subject I should be much obliged.

Yours faithfully,
(Signed) Edmund J. Baillie.

The Secretary,
Board of Agriculture,
Whitehall, London.

Royal Gardens, Kew, to Board of Agriculture.

Royal Gardens, Kew,
June 20, 1894.

Sir,

I have the honour to acknowledge the receipt of your letter No. 29,526, relative to the hybridisation of plants of swede and common turnip grown from seed.

2. There can, I think, be no doubt that plants in small numbers of different species or varieties of *Brassica* would be hybridised and would therefore not produce pure seed. It appears, however, to be found in practice that where these are grown in large, even if contiguous, breadths the amount of hybridisation, if any, is imperceptible.

I am, &c.
(Signed) W. T. Thiselton-Dyer.

The Secretary,
Board of Agriculture,
Whitehall, London.

CCCCIV.—MISCELLANEOUS NOTES.

The Flora of British India.—Botanists will congratulate Sir Joseph Hooker on the completion of the sixth volume of his great work, the first part of which was published 22 years ago. The enormous amount labour expended on this undertaking can only be realised by those engaged in similar labour. In this case the difficulties are greatly increased by the very numerous publications dealing with fragments of the India Flora, often from highly divergent views; to say nothing of the literature on the vegetation of the contiguous countries. The collection, collation, and digestion of this immense, scattered literature is indeed a herculean task, requiring an amount of persistent energy, possessed by very few persons. The seventh volume of the *Flora of British India* will contain the grasses, and a general corrected index to the whole. Sir Joseph Hooker has the most difficult order of flowering plants left to elaborate last. There are probably from 750 to 800 species of Indian grasses, the naming and synonymy of many of which demand an extraordinary amount of patience and perseverance to correct and unravel. There is absolutely no general foundation to work upon, for since the appearance of Kunth's *Enumeratio*, half a century since, there has been no critical synopsis of the plants of this order. Hence the elaboration of the India species involves the examination and comparison of the species of the world, at least in the case of many of the large and generally dispersed genera.

Flora of China.—The continuation of Mr. Hemsley's *Enumeration of the Plants of China*, with descriptions of numerous new species, appears in the *Journal of the Linnean Society*. It is hoped that the completion of the whole undertaking will not be long deferred. Dr. Masters has prepared the *Coniferæ*, and Mr. C. B. Clarke the *Cyperaceæ*. The present part carries the work down to the end of the *Euphorbiaceæ*.

African species of Musa.—Musa livingstoniana, Kirk, and **M. proboscidea**, Oliver. These two species of Musas belong to the subgenus *Physocaulis* of Baker, characterised by bottle-shaped stems and inedible fruits. *M. livingstoniana* was described by Sir John Kirk, G.C.M.G., K.C.B., in *Linn. Journ.* ix., p. 128, from the mountains of Equatorial Africa. In habit it is indistinguishable from *Musa Ensete*, but the seed is much smaller (only one-third of an inch in diam.), tubercled, with a depressed hilum, surrounded by prominent edges. In the Kew Museum there is a necklace of similar seeds brought by Barter from Sierra Leone. *M. proboscidea*, Oliver, is figured and described in *Hooker's Icones Plantarum*, t. 1777. The stem is four times the height of a man. The plant is known only from seeds and photographs obtained from Sir John Kirk. Its habitat is supposed to be the hills of Ukami, about 100 miles inland from Zanzibar. This species is remarkable for the extreme length of the rachis of the panicle. In Sir John Kirk's plant this drooped down and eventually become so elongated as to reach nearly to the ground. The seeds are about ½ in. long, with only a small hollow at the hilum. *M. proboscidea* has not yet been under cultivation in this country.

At Kew, *M. livingstoniana* has barely survived under a variety of treatment, none of which proved successful, for a number of years. It made a fair growth during the summer, but invariably died down during the winter months, finally failing to start again in the spring.

Sir John Kirk has been good enough to give the following further information respecting the two plants:—

Wavertree, Sevenoaks,
June 23, 1894.

DEAR THISELTON-DYER,

Musa livingstoniana I first discovered (but not in flower or fruit) in the Shiré Highlands, where I found the seeds were strung and worn by the women.

It was not heard of again until a native collector brought me plants from the Southern Usagara Hills behind Bagameyo, in what is now German East Africa. I put him on them by showing him the Nyassa seeds, which I happened to find exposed as an article of sale in the native bazaars in Zanzibar, where they were used by the Nyassa slave women. It was in getting me these plants that he also brought me ripe fruits of the Ensete Banana (*Musa Ensete*), and with them what proved to be the *M. proboscidea*, which I knew nothing of until it grew up and fruited in my garden.

As to the *M. proboscidea* you see although we have the plant and know far more of it than we do of the other, we know it only in cultivation in my garden in Zanzibar where, after I had once grown it, it came up abundantly from self sown seed, but whether it is still there I cannot say. However I will have a photograph taken off the negative of the plant as grown, which I still possess, and send it out to the lady who now has my old garden, and I will ascertain if the plant is still in existence, which is doubtful seeing that it forms no rootstock but comes up always from seed. The only hope is that the natives (freed slaves) used it as a medicine and were delighted when they recognised it, and so some of the slave population may have kept it going.

Yours, &c.
(Signed) JOHN KIRK.

Monstrous Cone of Pinus Pinea.—The Kew Museum is indebted to H.R.H. The Comte de Paris for a specimen of a monstrous development of a cone in this species, which so far as can be judged from previous published notices is in some respects, unique.

The cone which is apparently fully developed and normal has produced from its apex a stout leafy shoot, which at first only six inches long, after severance from the parent tree lengthened to more than a foot and produced three branches. The shoot is in fact in no way different from a normal branch and the feature of interest about it is that it was able to continue its growth for some time at the expense of the nourishment derived from the cone from which it sprang.

The circumstances are fully described in the accompanying letter:—

Palacio de Villamanrique,
Provincia de Sevilla (Espana)
April 27, 1894.

SIR,

I HAVE in my possession what I consider as a very curious botanical phenomenon, and I would gladly present it to the Kew Museum.

It is a frondiferous cone of the *Pinus Pinea*, out of the upper end of which has grown a young tree just as a pine-apple grows out of the crown of that fruit. Generally these cones fall only after having discharged their seeds. This one fell on the ground (how, I do not know) with the seeds still in it. It was picked up in a large *Pinar* or pine forest which I own in this neighbourhood by one of my keepers a day I was out shooting. The young tree was then about six inches long. The woodmen of this country say they never saw anything like it. I took the cone home and left it on a table, about the middle of February. It went on growing for a month, made a stem more than a foot long with three branches, and even threw out new shoots. About the end of March, although it was watered, it ceased to grow and died, although the needles did not fall and preserve their colour.

Believe me, &c.
(Signed) PHILIPPE, COMTE DE PARIS.

The Flora of Formosa.—Dr. A. Henry has added to his rich collections of dried plants from Eastern Asia by the gift of a further collection from Formosa, embracing about 1,750 numbers. Dr. Henry has not succeeded in reaching the mountains of the interior, which doubtless, judging from the Flora of Japan, support a rich endemic element; yet, from a cursory glance at a portion of this valuable addition to the Herbarium, there is evidently a considerable per-centage of novelties.

Handbook of the Flora of Ceylon.—After an interval of a twelvemonth the second part of Dr. Trimen's excellent work has been issued. It contains the Orders *Connaraceæ* to *Rubiaceæ*, and an index to parts one and two, with 25 quarto coloured plates, illustrating a selection of the more remarkable plants. The author has wisely altered the mode of publication originally decided upon; having separately paged this part, instead of continuing the pagination from part one. It is, or was, expected that two more volumes of about the same size would complete the work; but if the proportions of the Orders are about the same as in British India, a fifth will be necessary.

Visit of Botanical Officer of Gold Coast to the West Indies.—On the suggestion of Sir W. Brandford Griffith, K.C.M.G., it was arranged that Mr. William Crowther, Curator of the Botanic Station at Aburi on the Gold Coast, should visit the West Indies during the winter of 1893–94. The object in view was "to enlarge his knowledge of the " cultivation of valuable tropical economic plants, to observe the system " and arrangements pursued at the Botanic Stations in that part of the " world, and to procure and bring back such useful seeds and plants as " might be of advantage to introduce to the Gold Coast." Mr. Crowther left England on the 11th October 1893, and returned on the 11th January 1894. He was furnished with credentials from the Colonial Office to the Government of Barbados, Jamaica, Trinidad, and British Guiana, which were requested by the Secretary of State to afford him every facility. Mr. Crowther's report on his visit has now been published by the Colonial Office. By his previous training at Kew and the pioneering work he had passed through at the Gold Coast he was in the best position to profit by what came under his observation. At Jamaica he saw for the first time large and well-established botanic gardens in the tropics. Besides successful industries in sugar, coffee, spices, and fruit, and he was able to judge how far negro labour, well managed and conducted, could be utilised in maintaining them. At St. Vincent and Grenada he saw botanic stations, like his own, in efficient order; while at Trinidad and British Guiana there were both successful botanic gardens and numerous tropical industries offering a wide field for observation. He visited "a number of private estates in each colony, " and carefully studied the mode of cultivation and the methods of " curing and manufacturing the produce." Mr. Crowther is satisfied that, following the example of Lagos, youths from the Gold Coast should be sent to botanical establishments in the West Indies to be trained for service in their own country. " On their return," he says, " they would " be qualified to take charge of branch stations which might be " established in other parts of the Colony, and also to hold responsible " positions at the chief station at Aburi." There can be little doubt that Mr. Crowther's visit will be most beneficial in its results to the botanic station at Aburi and the Government of the Gold Coast secures the wide experience and knowledge of an officer who had already shown himself capable of excellent work in the Colony.

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 92.] AUGUST. [1894.

CCCCV.—SPECIES AND PRINCIPAL VARIETIES OF MUSA.

The tribe *Museæ* forms a part of the important Natural Order SCITAMINEÆ, which includes numerous economic plants such as Arrowroot, Turmeric, Cardamoms, Ginger, and Cannas. It embraces four genera, all of interest:—*Heliconia*, *Musa*, *Strelitzia*, and *Ravenala*. The Heliconias are natives of the New World, and represent in habit the wild Musas of the Old. The Musas themselves include the wild and cultivated bananas and plantains, and are indigenous to the Old World and Polynesia. The Strelitzias are plants with distichous leaves, and their flowers are large, white, blue, or orange coloured; they are restricted to South Africa. The Ravenalas, two species only, are found in such widely-separated countries as Madagascar and Guiana. They are the well-known "travellers'-palms," whose leaves on long stalks arranged like the ribs of a fan are striking objects in many tropical countries.

Musas are the largest of tree-like herbs, often attaining, with the leaves, a height of 25 to 40 feet. They have not inappropriately been compared by Meneghini and Achille Richard to "gigantic leeks." These plants can be grown over an immense area of the earth's surface, and are found either wild or cultivated from 38° N. lat. to 35° S. lat.

There are about 40 described species of *Musa* known (in various parts of the world) and about one-half of these are now under cultivation in this country. The edible fruited species seem to have migrated with mankind into all the climates in which they can be grown, and are universally cultivated in the equatorial zone for purposes of shade and food. Le Maout and Decaisne say:—

"Bananas and plantains afford such desirable food that their cultivation is not less important in the tropics than that of cereals and farinaceous tubers in temperate regions."

In West Africa, Monteiro (*Angola and the Congo*, I., 294) speaks thus of these plants:—

"Bananas and plantains grow magnificently where the rich, moist earth in which they delight is found, . . . and they rear their magnificent leaves unbroken by a breath of air. A grove of banana trees thus growing luxuriantly in a forest clearing is one of the most beautiful sights in nature; the vast leaves reflecting the rays of the hot sun from their bright green surface contrast vividly with the dark-hued foliage of the trees around, and show off the whorls of flowers with their fleshy, metallic, purple-red envelopes and the great bunches of green and ripe yellow fruit."

Burton passed through groves of cultivated plantains in Central Africa during "a whole day's march"; while Johnston in Eastern Africa regarded "the groves of emerald green bananas everywhere met with as marking the commencement of the cultivated region."

Belt's observations in the New World are:—

"The banana tree shoots up its succulent stem and unfolds its immense entire leaves with great rapidity; and a group of them waving their silky leaves in the sun, or shining ghostly white in the moonlight, forms one of those beautiful sights that can only be seen to perfection in the tropics."

An excellent general account of the plantain and banana was given by the late Professor Lindley in *Trans. Roy. Hort. Soc.*, V. pp. 83–84:—

"The plantain or banana, with which as a tree no one can be unacquainted, is the principal fruit consumed by the inhabitants of the torrid zone; and from its nutritious qualities and general use may, whether used in a raw or dressed form, be regarded rather as a necessary article of food than as an occasional luxury. In equinoctial Asia and America, in tropical Africa, in the Islands of the Atlantic and Pacific Ocean, wherever the mean heat of the year exceeds 75° Fahr., the banana is one of the most interesting objects of cultivation for the subsistence of man. The fruit is produced from amongst the immense leaves in bunches weighing 30, 60, and 80 lbs., of the richest hues, and of the greatest diversity of form. It usually is long and narrow, of a pale yellow or dark red colour, with a yellow farinaceous flesh. But in form it varies to oblong and nearly spherical; and in colour it offers all the shades and variations of tints that the combination of yellow and red, in different proportions, can produce. Some sorts are said always to be of a bright green colour. In general, the character of the fruit to an European palate is that of mild insipidity; some sorts are even so coarse as not to be edible without preparation. The greater number, however, are used in their raw state, and some varieties acquire by cultivation a very exquisite flavour, some of them surpassing the finest pear. In the better sorts the flesh is no harder than butter is in winter, and has much the colour of the finest yellow butter. It is of a delicate taste, and melts in the mouth like marmalade. To point out all the kinds that are cultivated in the East Indies alone would be as difficult as to describe the varieties of apples and pears in Europe; for the names vary according to the form, size, taste, and colour of the fruits."

Besides the fruit-yielding Musas there are many species so ornamental that they are surpassed by few plants admired for their gigantic stature and graceful foliage. The largest of these is the Abyssinian *Musa Ensete*, first described by the traveller Bruce. The leaves in fine specimens are nearly 30 feet long and about 3 feet wide. The smallest species is a singularly interesting one recently discovered by Delavay in Western China (*Musa lasiocarpa*). There is no apparent stem and the leaves are only about a foot long. Between these two extreme forms there are numerous intermediate ones, all graceful and attractive, some with bright red flower-bracts. Others, again, remarkable for their mottled or banded leaves, are cultivated for their beauty. In spite of their value as food plants and their wide distribution, Musas have not by any means been studied carefully, and there is no standard work existing giving an adequate account of their history, origin, and distribution in various parts of the world. The information respecting them is scattered through numerous books which are seldom accessible except in large libraries. A paper on *Les differentes espées dans le genre Musa* (Bananier), by Dr. Sagot, was published in the *Journal de la Société Nationale d'Horticulture de France*, April and May, 1887. Dr. Sagot divided the Musas (or Bananas as he called them) into three groups as follows:—

1. The Giant Bananas, of which *M. Ensete* is the type. In this group no suckers are formed. The fruit is inedible and leathery, seeds few.
2. Fleshy-fruited Bananas, with *M. sapientum* as the type. Stem producing suckers; spike long and decurved; fruit fleshy and usually edible.
3. Ornamental Bananas. Spike often erect, not pendent, bracts persistent, brightly coloured, each with only a few flowers in its axil, suckers many, fruit leathery. *M. rosacea* and *M. coccinea* are familiar examples of this group.

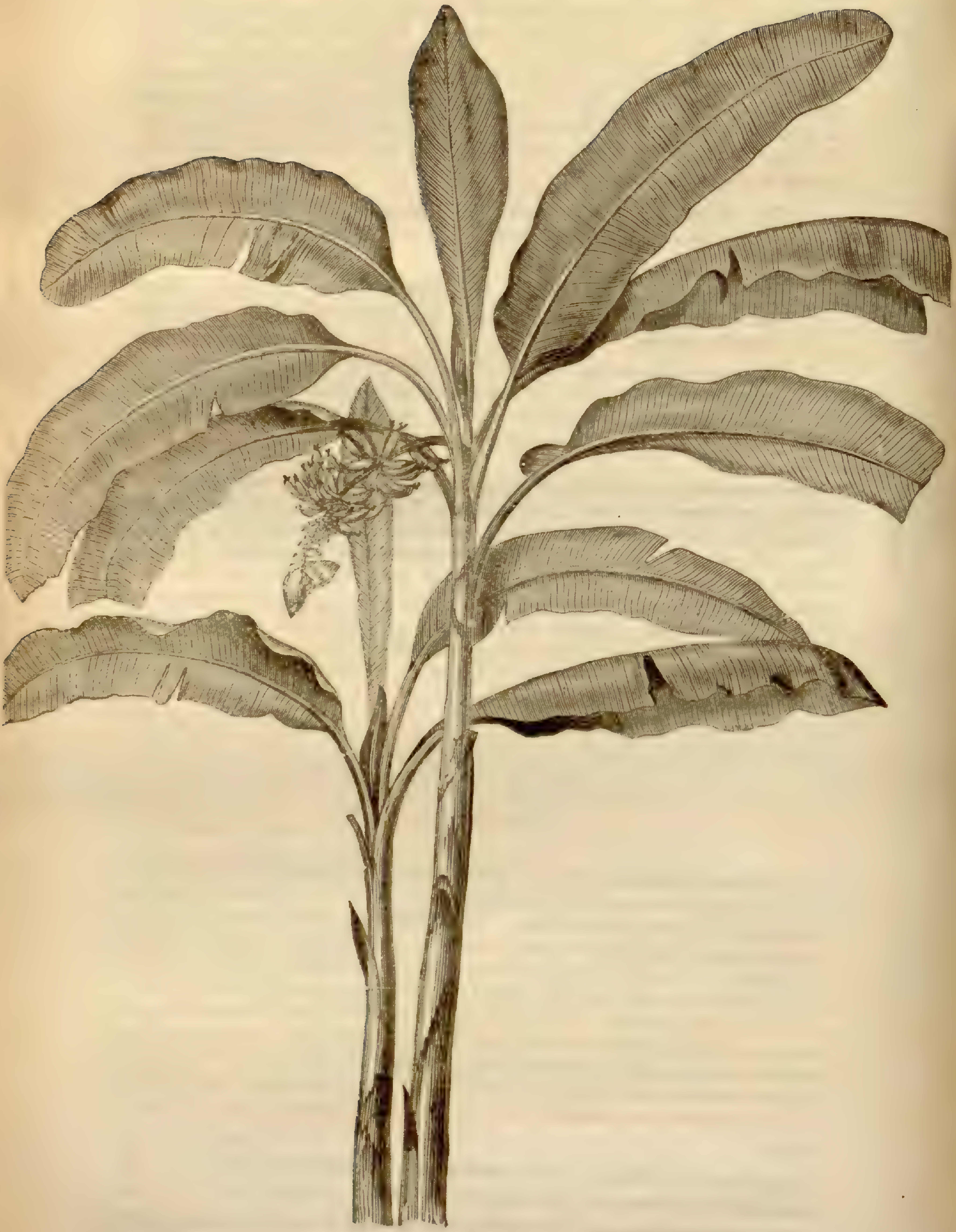
More recently, in 1893, *A Synopis of the Genera and Species of Museæ*, prepared by Mr. J. G. Baker, F.R.S., was published in the *Annals of Botany*, Vol. VII., pp. 189-222. This contains a key to the sections and species and brief descriptions of 32 species of *Musa* and several varieties. Mr. Baker's paper brings together, for the first time, a complete review of the genus, and a starting point is established from which to make further investigations. The chief features in it are incorporated here. The sub-generic distinctions adopted by Mr. Baker are based on the shape of the stem, the number of flowers to a bract, the shape of the petal, and the colour of the bract. His divisions, like those of Sagot, are three, and they practically include almost the same species.

DESCRIPTIVE.

The **stem** (pseudo-stem) in Musas usually arises from a perennial rootstock which is made up of a number of successive shoots extending outwards from the original base. The apparent stem arising from each shoot is composed at one stage of nothing but the convolute sheaths of the leaves. The sheaths of the leaves in this case are tightly packed one over another, and the outermost generally covers about three-fourths of the circumference. The inner sheaths, occupying the centre, are very narrow and tightly rolled, but they gradually widen as they come nearer the outer surface of the stem. When the plant is about to flower the bud, which starts from the base, is pushed up through the centre of the leaf-sheaths and appears at the top from among the expanded leaves.

Graham (*Bot. Mag.*, t. 3849) had carefully noticed the growth of the flower-bud of Musas in this country in 1840. He says:—

"The flower-bud, as I have proved by cutting down full-grown plants of *Musa rosacea* and *Cavendishii*, and I think also of *M. paradisiaca*, remains at the root till a time after the plant has attained its full size, varying according to its treatment, and then pushes its way upwards—



Plantain.

Musa sapientum var. *paradisiaca.*

its appearance at the top of the stem being preceded by the evolution of one or more leaves smaller than the rest."

Observations on this point have been made lately at Kew. (1.) A stem of *M. sapientum*, about 12 months old, was cut down before flowering when nearly, but not quite, fully grown. The whole stem was 15 feet high. Cut longitudinally, it showed at the base a conical body rising in the centre about 8 inches above the attachment of the outermost leaves. From the apex of the cone the flower bud had already started. It was on a slender leafless stalk about an inch in diameter. The bud itself was found about 4 inches higher. In this case it had evidently just begun to grow. (2.) In a plant of *M. Basjoo*, apparently fully grown, the conical axis was 10 inches in diameter at the base, invested at that point by a few leaf-sheaths. A foot higher with the stem of leaf-sheaths 9 inches in diameter, the flower stalk was an inch and a half in diameter. By carefully following it, the top of the flower bud was found at 3 feet from the base, forming a club-shaped body easily recognised by a bulging out of the innermost leaf-sheaths. Here the flower bud was found about one-third of the way up the stem. (3.) Finally a stem of *M. sapientum* that had already borne fruit was examined. It was about 12 feet high. At a foot above the conical base the fruiting stalk, cut through, was one and three-quarter inches in diameter. It preserved the same diameter and was traced as a slender, white, fibrous body, over 12 feet high, closely invested by the leaf-sheaths, until it emerged from amongst the petioles of the leaves. It then became coloured green and curved downwards.

These observations fully confirm what has just been quoted from Dr. Graham. They show that the rate of growth of the flower bud must be very rapid. In the tropics where the whole plant matures and ripens its fruit within 12 months, the flower bud probably takes only a few weeks to push its way from the base to the top of the stem. From the time of flowering until the fruit is ripe takes about six to eight weeks. In the non-stoloniferous species the whole plant is strictly monocarpic, and reproduces itself not by shoots but by seeds.* The majority of species are, however, reproduced by buds or shoots which spring from the perennial rootstock.

The shape of the pseudo-stem varies a good deal. In one section the stems are bottle-shaped, having a swollen distended appearance. This is very noticeable in *M. superba*. Usually the stem is cylindrical, gradually tapering from the base upwards. In *M. Ensete* the stem is 6 to 10 feet high, and very stout. In *M. Hillii* it is about 30 feet high, and moderately stout only. Again, in *M. Mannii*, it is only 2–3 feet high and 1 inch in diameter.

The stems of most species are green, with occasional blotches of black, red, or purple. Those in the banana (*M. sapientum*) are often described as green and "purple spotted"; while in the plantain (variety *M. paradisiaca*) they are said to be wholly "green." These characters are, however, not constant. The stem of *M.* (*sapientum*) *dacca* is "pruinose," and appears covered with glittering particles of fine dew. In *M.* (*sapientum*) *rubra* the stem is dull-red, while the interesting *M. Fehi* has a greenish stem with violet juice.

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* Kurz, however, remarks that even in non-stoloniferous species shoots are occasionally produced. "I remember," he says, "a plant of *Musa glauca* in the Botanical Gardens at Java, which threw out two shoots; and if accounts be correct *M. Ensete* is said to make shoots if the whole plant is cut down before flowering."

The **leaves**, arranged in a loose rosette, are large, oblong, and entire, with a very prominent midrib, and numerous straight, transverse veins. The free portion of the petiole may be long or short. Usually the leaves are bright green on both sides, sometimes darker above and glaucous beneath, rarely with a narrow red edge. In the young state the leaves have narrowly hyaline margins, either beautifully crimson or white. The midrib is semi-cylindrical below, with a deep rounded groove above. The blades on each side of the midrib are generally flat, but sometimes hang down. The large leaves of *M. Ensete* have been already noticed, the petiole is short, broad, deeply channelled. The midrib is red. In *M. Cavendishii* the leaves are arranged in a dense rosette, and are rather glaucous. The petiole is short and stout, with two broad, crisped, green edges. The leaves in *M. discolor* are glaucous, tinged with violet or red. In *M. Fitzalani* they are patent; in *M. rosacea* linear-oblong, and tinged with purple beneath. *M. zebrina* has the leaves barred with purple; *M.* (*sapientum*) *vittata* barred with white; and *M. sumatrana* with irregular blotches of claret-brown.

From the centre of the leafy envelopes at the top of the pseudo-stem emerges the flowering **spike**, which tapers very slightly upwards. Only the uppermost part of it becomes exserted from the leaf-crown, and it is often furnished here with comparatively diminutive cauline leaves, which more or less abruptly pass into the floral bracts. This spike varies greatly in size and length, not only with the species, but according to soil and treatment under cultivation.

It is composed of many clusters of flowers arranged at intervals along the rachis. Each cluster is subtended by a large spathaceous and membranous bract. The lower part of the rachis, or the peduncle, is as often shortly tomentose or puberulous as it is glabrous, and such variations, according to Kurz, occur in the same variety. It is also furrowed, although the furrows are often obsolete. In some species the spike is erect, as in *M. Fehi*. In *M. discolor* it is drooping, and as long as the leaves. In *M. proboscidea* is nearly as long as the pseudo-stem (5–6 feet).

The **bracts** are most conspicuous and large in all species of *Musa*. They are important in the discrimination of species. They entirely cover the half-whorls of flowers, and are so densely laid one upon the other that they form a sort of flower cone, which the Malays call *djantong*. The lowermost bracts are always larger and more elongate, and bear usually no flowers in their axils. The nature of the outside of the bracts, whether furrowed and variously pruinose to mealy, or smooth and glossy to almost polished, furnishes good distinctive characters. The colour, too, is of value, although great variations occur. The enormously large bracts of *M. Ensete*, 1½ to 2 feet long, are claret-brown and persistent. In others they fall off with the abortive flowers. *M. sapientum* has bracts of a dull violet colour more or less glaucous outside. In one section (*Rhodochlamys*) the species have very highly coloured bracts, generally red or yellow. *M. salaccensis* has pale lilac bracts, while in *M. coccinea*, a very ornamental species, they are bright red, tipped with yellow; in *M. aurantiaca* they are bright orange.

The **flowers**, arranged in half-whorls, are inserted upon crescent-shaped protuberances of the rachis. They are usually arranged in two rows and subtended by the bract. The lowermost clusters of flowers are generally female or pistillate (or as Kurz describes them hermaphrodite-female) as the stamens are reduced or absent. The whorls further along the rachis have staminate or male flowers (hermaphrodite-male) as, although the pistil is present and smaller, it is not functional. In a general sense the lowermost flowers are said to be female and the upper male flowers. Hence it is only the lowermost flowers, near the base, that produce fruit, and the normal state is to have only a few fruit-whorls at this part, while the male-hermaphrodite flowers and their bracts drop off successively leaving a warted nude rachis, terminating in a flower cone formed by the innermost bracts of the male flowers. Fertilization in bananas is probably affected by the action of the wind; the pollen is spherical and smooth. In *M. Ensete*, Kurz describes the pollen grains as tubercled. In many cases the conditions are favourable to self-fertilization, especially when the whole spike consists of hermaphrodite flowers. Under glass it would no doubt be an advantage to fertilize the flowers artificially, as thereby a more abundant crop of fruit would be produced, and rare species preserved. This was successfully done at Kew in regard to *M. Ensete* in 1860, and repeated with other species later. Cross fertilization also might be effected in order to produce new varieties. It is possible that in the natural state this has influenced varieties to a larger extent than is supposed.

There is a tendency to abnormal parts in the flowers of Musas, but usually they are as follows:—

The *calyx* at first tubular, is soon slit down one side, and 3–5 toothed at the apex. The *petal*, placed opposite the calyx, is simple or tricuspidate. The *stamens* are normally six, but one is usually suppressed: in the others the anthers are two-celled and basifixed. *Ovary* cylindrical, three-celled; ovules many in a cell, superposed; style filiform from a thickened base; stigma shortly lobed.

The **fruit** is a berry, elongate or short, pulpy or dry, angular, oblong, or cylindrical. The sharpness and distinctness of the corners of the fruit depend upon the amount of pressure to which they are subjected in the whorls. Consequently the angles are sharper where the fruit whorls are more crowded and compact. On the other hand, where the fruits are very loosely disposed they are more rounded or terete.

Seeds, when produced, are sub-globose or angled by pressure, often excavated at the hilum. The testa is very hard, intruded at the base and apex; albumen mealy, the embryo sub-truncate.

There is great variety as regards the size, shape, colour, and texture of the fruit. In one section (***Physocaulis***) the fruit is always coriaceous or leathery, with numerous large sub-globose angled seeds. In the pulpy or edible-fruited species the fruit, when ripe, may be smooth or rough, opaque or glossy, yellow or reddish; or it may be bright yellow, violet, tinged with blood red, straw-yellow, yellowish red, yellowish green, or white. It may be from 3 to 10 or even 18 inches long, oblong, cylindrical, or indistinctly angular, sometimes with a blunt end or sometimes produced, as in the singular "duck plantain" of the Malays, with a beak nearly as long as its body. It may be shortly stalked, sessile or produced at the end of pedicels 2 or 3 inches long. In the section ***Rhodochlamys*** only one species (*M. maculata*) produces edible fruit, the others have small dry fruit, filled with seeds, and not edible. In *M. velutina* the fruit is velvety and bright red, in *M. lasiocarpa*, pubescent, with 4–6 seeds filling up the whole cavity.

In the pulpy or edible-fruited species, known as bananas or plantains, the fruits are arranged in clusters. Some stand straight out; others are slightly curled outwards and upwards; while not a few are quite recurved pointing upwards parallel with the rachis and overlapping each other. Again, the fruits may be loosely arranged, hardly touching one another; or they may be compactly or even densely crowded together so as to completely hide the rachis. The Jamaica banana, for instance, has the fruits "compactly but not densely arranged, recurved, almost parallel with the axis." In the Surinam banana the fruits "are laxly arranged, the first series somewhat re-curved, the rest spreading nearly at right angles to the axis." In the Chinese or dwarf banana the fruits "are lax, spreading outwards, hardly overlapping." The plantains (the vegetable) have generally fewer and looser fruits. These may be "laxly spreading outwards" or "curled upwards like a horn." The individual fruits are usually larger than in the banana. The pulp firm and the colour yellowish-green, or yellow when ripe, not red.

The fruit clusters are called "hands." Each hand may vary from 3 to 10 (or in exceptional instances) to 18 on each spike. Again, a hand may consist of 8 to 18 single fruits or "fingers." The total number of fruits produced on a "bunch" may be as low as 24, or as high as 250 or more. The weight of a bunch may be from 30 to 90 pounds (avoir.).

After fruiting the stem dies. Its place is however taken by several new shoots or stolons thrown up from the base. These grow closely together, and the next year two or three may bear bunches of fruit. When once planted the produce of banana trees on a small area is exceptionally large. Hence Humboldt has calculated that, although less nutritious than wheat or potatoes, yet the space occupied by their culture and the care required render the produce of bananas compared to wheat is as 123 to 1, and to that of potatoes as 44 to 1.

The bananas (using the word in a general sense) are amongst those cultivated plants of which we know the wild stock; we are also acquainted with one or more intermediate forms between the wild and cultivated so that the transition in the evolution of the pulpy fruit without seeds from the dry fruit full of seeds can be observed. In the case of *M. Fehi*, found wild in Tahiti, Fiji, and New Caledonia, according to Dr. Sagot well-formed seeds are not very common, and hence this species exhibits even in the wild condition a tendency to abortion of the seeds and a compensating hypertrophy of the pulp. Musas in a wild state are chiefly found in India, the Malay Archipelago, Cochin-China, Philippines, Northern Australia, and the islands of the Pacific. A remarkable group of large species with swollen stems and leathery fruits are found in Africa. The true bananas are apparently Indian, Malayan, and Polynesian. They have been cultivated from the earliest times, and the facility with which suckers can be transported, and the long period during which they retain their vitality, have rendered them particularly easy of distribution. There are no plants that require less care to establish.

The most familar of cultivated Musas are those originally described by Linnæus as *M. sapientum* and *M. paradisiaca*.

SPECIES OF MUSA.

Although it has usually been believed that only one or two species of *Musa* yield edible fruit it will be found that besides the numberless varieties of *M. sapientum*, including the common bananas or plantains of tropical countries, there are several other species which are cultivated

Musa Ensete, Gmel.

(*Botanical Magazine*, t. 5223.)

for their fruit, and not a few that are grown for other purposes, such as yielding an edible rootstock or for the sake of the tender flower bud eaten as a vegetable. The most widely cultivated species next to *M. sapientum* is *M. Cavendishii*, the dwarf or Chinese banana, introduced to Europe within the last 50 years. Then, according to Kurz, a large proportion of the best varieties of plantains cultivated in the Malay archipelago are derived from *M. acuminata.* A very palatable fruit with violet pulp is yielded by *M. discolor* in New Caledonia. *M. Fehi* has an erect fruiting spike, and the fruit, when cooked is universally used in the Pacific Islands. Lastly, *M. maculata* with a yellow fruit spotted with brown, known only as cultivated in Mauritius and Bourbon under the name of *Figue mignonne*, has an aromatic white pulp. The rhizome of *M. oleracea* is boiled or roasted like a yam; and the inner bud of *M. Ensete* is a source of food supply in Abyssinia. In some form or other, however, every species of *Musa* is of economic importance and the numerous uses to which they are put in various parts of the world are only equalled possibly by the palms and bamboos.

The three sub-genera into which *Musa* is divided by Mr. Baker are as follows :—

1. Sub-genus **Physocaulis** (Swollen-stemmed Musas).—Stem bottle-shaped and usually not stoloniferous. Flowers many to a bract. Petal usually tricuspidate. Fruit not edible. In this group are all the species known to be indigenous to Africa, namely: *M ventricosa*, *M. Buchanani*, *M. livingstoniana*, and *M. proboscidea.* Of Asiatic species Mr. Baker gives two, *M. superba* and *M. nepalensis.* The latter said to be from the "lower hills of Nepal" has not been found since the days of Wallich and is quite unknown at the present time.
2. Sub-genus **Eumusa** (true Musas).—Stem cylindrical, gradually tapering from the base, usually stoloniferous. Flowers many to a bract. Petal ovate-acuminate. Bracts green, brown, or dull violet. Fruit usually edible. The species in this group divide naturally, according to their height, into dwarf-stemmed and tall-stemmed species. The dwarf are two Chinese species, *M. lasiocarpa* and *M. Cavendishii*. The tall are *M. sapientum* and its allies about a dozen species in all. They are widely distributed throughout Eastern Asia, India to China, and Japan, Borneo, New Guinea, North Queensland, and the Islands of the Pacific.
3. Sub-genus **Rhodochlamys** (red-bracteated Musas).—Stem cylindrical as in true Musas, usually stoloniferous. Flowers few to a bract. Petal linear. Fruit usually not edible. Bracts bright coloured, often red. Twelve species are included here. One only (*M. maculata*) yields edible fruit. The others, such as *M. coccinea*, *M. rubra*, *M. velutina*, and *M. aurantiaca*, owing to their brightly coloured bracts, are very ornamental. All are from India, Assam, Sumatra, Java, and Cochin-China.

Key to the Sub-genera and Species of Musa.

Sub-genus Physocaulis, *Baker*. Stems short, bottle-shaped. Male flowers many to a bract. Fruit not edible. Usually not stoloniferous.

Seeds few, large (about an inch broad) :

Male flowers 15–20 in a row.	
Petal tricuspidate - - -	1. *M Ensete.*
Petal ovate, entire - - -	2. *M. ventricosa.*
Male flowers, about 10 in a row -	3. *M. Buchanani.*

- Seeds many, comparatively small :
  - African :
    - Hilum of the seed deeply depressed, surrounded by prominent edges - 4. *M. livingstoniana.*
    - Hilum of the seed, but slightly depressed - - - - 5. *M. proboscidea.*
  - Indian :
    - Flowers 10–15 in a row ; bracts sub-orbicular, claret-brown - 6. *M. superba.*
    - Flowers 7–8 in a row ; lower bracts ovate, dull lilac - - 7. *M. nepalensis.*

Sub-genus Eumusa, *Baker*. Stems cylindrical. Male flowers many to a bract. Fruit generally edible. Usually stoloniferous.

- Dwarf species, with short petiole :
  - Membranous yellow bracts and pubescent fruit - - - - 8. *M. lasiocarpa.*
  - Bracts firmer ; fruit glabrous :
    - Stem very short ; many upper flowers sterile - - - - 9. *M. Cavendishii.*
    - Stem longer ; flowers all fertile - 10. *M. nana.*
- Tall species, with long petiole :
  - Petal small, tricuspidate - - 11. *M. glauca.*
  - Petal ovate, entire :
    - Fruit narrowed into a beak :
      - Fruit many, smaller - 12. *M. acuminata.*
      - Fruit few, larger - - 13. *M. corniculata.*
    - Fruit not narrowed into a beak :
      - Spike dense, erect or sub-erect :
        - Fruit not edible, ovoid - 14. *M. Hillii.*
        - Fruit edible, oblong - 15. *M. Fehi.*
      - Spike drooping :
        - Fruit with a long distinct stipe - - - 16. *M. Banksii.*
        - Fruit with a short distinct stipe - - - - 17. *M. Fitzalani.*
        - Fruit sessile, or sub-sessile :
          - Leaves firm in texture, yielding good fibre 18. *M. textilis.*
          - Leaves not firm in texture, yielding poor fibre :
            - Leaves smaller, glaucous - 19. *M. discolor.*
            - Leaves, larger, green :
              - Petal as long as calyx - 20. *M. Basjoo.*
              - Petal shorter than calyx :
                - Rachis of spike pubescent :
                  - Bracts brown outside- 21. *M. malaccensis.*
                  - Bracts yellow outside 22. *M. flava.*
                - Rachis of spike glabrous 23. *M. sapientum.*

Sub-genus RHODOCHLAMYS, *Baker*. Stems slender, cylindrical. Male flowers few to a bract. Fruit not generally edible. Usually stoloniferous.

Fruit edible; bracts yellow-brown - 24. *M. maculata*.
Fruit not edible:
  Leaves large; fruit distinctly stipitate - 25. *M. sumatrana*.
  Leaves smaller; fruit not distinctly stipitate:
    Bracts pale or dark lilac:
      Petal shorter than the calyx - 26. *M. violascens*.
      Petal nearly or quite as long as the calyx: -
        Flowers yellow - - 27. *M. rosacea*.
        Flowers greenish - - 28. *M. salaccensis*.
    Bracts red:
      Fruit hairy - - - 29. *M. velutina*.
      Fruit glabrous:
        Petal nearly or quite as long as the calyx:
          Bracts crimson - 30. *M. coccinea*.
          Bracts pale red - 31. *M. rosea*.
          Bracts blood-red - 32. *M. sanguinea*.
        Petal much shorter than the calyx:
          Bracts bright red - 33. *M. rubra*.
          Bracts pale red - 34. *M. Mannii*.
          Bracts bright orange 35. *M. aurantiaca*.

Sub-genus Physocaulis.

Swollen-stemmed Musas.

[An asterisk is prefixed to those species and varieties of which examples are in cultivation at Kew.]

*1. **Musa Ensete**, *Gmel*. Abyssinian Banana. Native name "Ensete." *Bot. Mag.*, t. 5223–4. North Gallery, No. 516. Whole plant 30–40 feet high. Stem swollen at the base, not stoloniferous. Leaves oblong acute, sometimes 20 feet long and 3 feet broad with a red midrib. Bracts densely imbricated 9 to 12 inches long, dark claret brown. Fruit coriaceous, dry, 2 to 3 inches long. Seeds 1–4 black, glossy, nearly an inch broad with a prominent raised border round the hilum. *Distribution:*—Mountains of Abyssinia to the hills of equatorial Africa; southward of Victoria Nyanza Lake. The largest known banana. The flowers of a specimen that flowered at Kew in 1878 are preserved in the Kew Museum; also a series of seeds from Abyssinia (Plowden); Nyanza Lake (Kirk); prepared fibre from stem from Abyssinia (Plowden), Jamaica (Morris), and a specimen grown at Kew.

It was discovered by the traveller Bruce and is remarkable as being represented on ancient Egyptian sculptures. Plants growing in the cool climate of the Blue Mountains in Jamaica at 4,000 feet are described by Mr. Morris (*Native and other Fibre Plants*, 1884, p. 38) as having "leaves 20 feet long; the stem about 8 feet in circumference at the base, with a height of 30 feet; the total weight of a single plant was not less than a quarter of a ton." An illustration of the Jamaica plant is given in the *Gardeners' Chronicle*, 1881 [1], p. 435. This species is well adapted for sub-tropical countries such as South California, Florida, Algeria, and Canary Islands, and is often put out for the summer in the London Parks. When established in sheltered situations it is a very ornamental plant having a noble and majestic habit. The fruit is useless for purposes of food. As the plant produces no offsets and perishes after fruiting it is propagated entirely from seed.

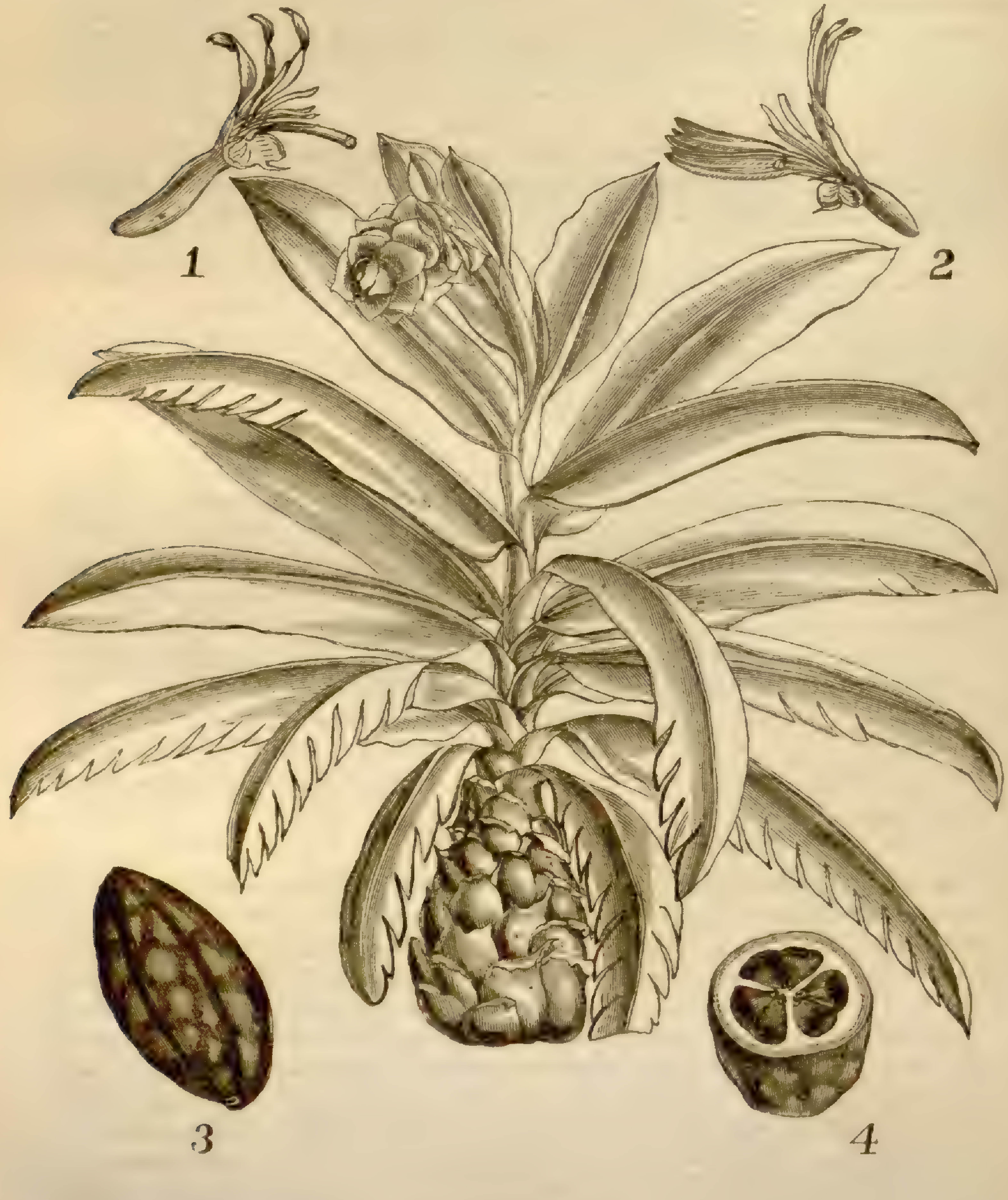
*2. **M. ventricosa**, *Welw.* Whole plant 8 to 10 feet high. Stem much swollen, 4 feet in diameter at the base. Leaves oblanceolate-oblong, 4 to 5 feet long, thick in texture, with a pale-red midrib. Differs from other species of this section by its entire petal. Fruit like that of *M. Ensete.* Seeds large, dull black with a broad hollow at the hilum. *Distribution:*—Found in Angola, province of Pungo Andongo, in rocky places near rivulets 10° S. lat. by Welwitsch. *M. africana*, Bull. Cat., is probably this species in a young state; as also a plant lately received at Kew from St. Petersburgh under the same name. Seeds of this species are in the Kew Museum.

3. **M. Buchanani**, *Baker.* Nearly allied to *M. Ensete*, but the bracts are linear-oblong, 1–1½ feet long, 2½–4 in. broad. Flowers 10 in a row. Seeds as large as those of *M. Ensete*, glossy, black, not tubercled. Dried specimens only received from Mr. John Buchanan, C.M.G., from the Shiré Highlands, East Africa, 1885.

4. **M. livingstoniana**, *Kirk.* Stem conical, twice the height of a man, 2–3 feet diameter at the base. Leaves narrow oblong, crowded, as long as the trunk, with a short, broad-clasping, deeply channelled petiole. Fruit many seeded 4 inches long. Seeds globose, angled by pressure in the lower half, ⅓ inch diameter, dull brown tubercled with a depressed hilum, surrounded by prominent edges. Described from sketches, notes, and seeds brought from south-east tropical Africa by Sir John Kirk, G.C.M.G. *Distribution:*—Between 12° and 19° S. lat. in region of Lake Nyassa. A necklace of similar seeds is in the Kew Museum sent from Sierra Leone by Barter. This species has once been under cultivation at Kew, but is probably unknown in Europe at the present time. *Kew Bull.* 1894, pp. 225–226.

5. **M. proboscidea**, *Oliver*, in *Hooker's Icon. Plant*, t. 1777. Trunk dilated at the base, reaching 4–5 times the height of a man. Leaves narrow-oblong, very large, narrowed to the base; free petiole, short, deeply channelled. Spike finally drooping, very much elongated, nearly as long as the stem; bracts broad, ovate, obtuse, about 4 times as long as the flowers; flowers in two close rows of about 12 in a row. Petal very short with two orbicular outer lobes, and a large linear central cusp. Seeds turbinate, black, glossy, ½ inch broad and long, with only a small hollow at the hilum. *Distribution:*—Known from seeds and four photographs in the Kew Museum procured by Sir John Kirk, G.C.M.G., from the Hills of Ukami, about 100 miles inland from Zanzibar. *Kew Bull., loc. cit.*

*6. **M. superba**, *Roxb.* *Bot. Mag.*, t. 3849–50. Whole plant reaching a height of 10–12 feet. Trunk not stoloniferous, much dilated, 7–8 feet in circumference at the base, narrowed to 3 feet below the leaves. Leaves oblong, narrowed to the base; free petiole, very short, deeply channelled. Spike at first globose, a foot in diameter, finally drooping, a third the length of the trunk; bracts orbicular, dull claret-brown, reaching a foot in length and breadth; flowers in two dense rows of 10–15 each. Petal short, tricuspidate, with a large linear central cusp. Fruit oblong, sub-coriaceous, 3 inches long, $1\frac{1}{2}$ inches diameter. Seeds very numerous, sub-globose, angled by pressure, $\frac{1}{3}$–$\frac{1}{2}$ inch diameter, smooth, brown. *Distribution:*—Western Ghauts of the Bombay Presidency. Native name at Nasik, *Chavai.* According to Dr. Ritchie, this species is stemless on rocks in the Rama Ghauts. Fruits are in the Kew Museum from Travancore (1874) and Trivan-



Musa superba, Roxb.
(Whole plant greatly reduced.)
1. Pistillate flower. 2. Staminate flower. 3. Fruit. 4. Cross section of fruit.

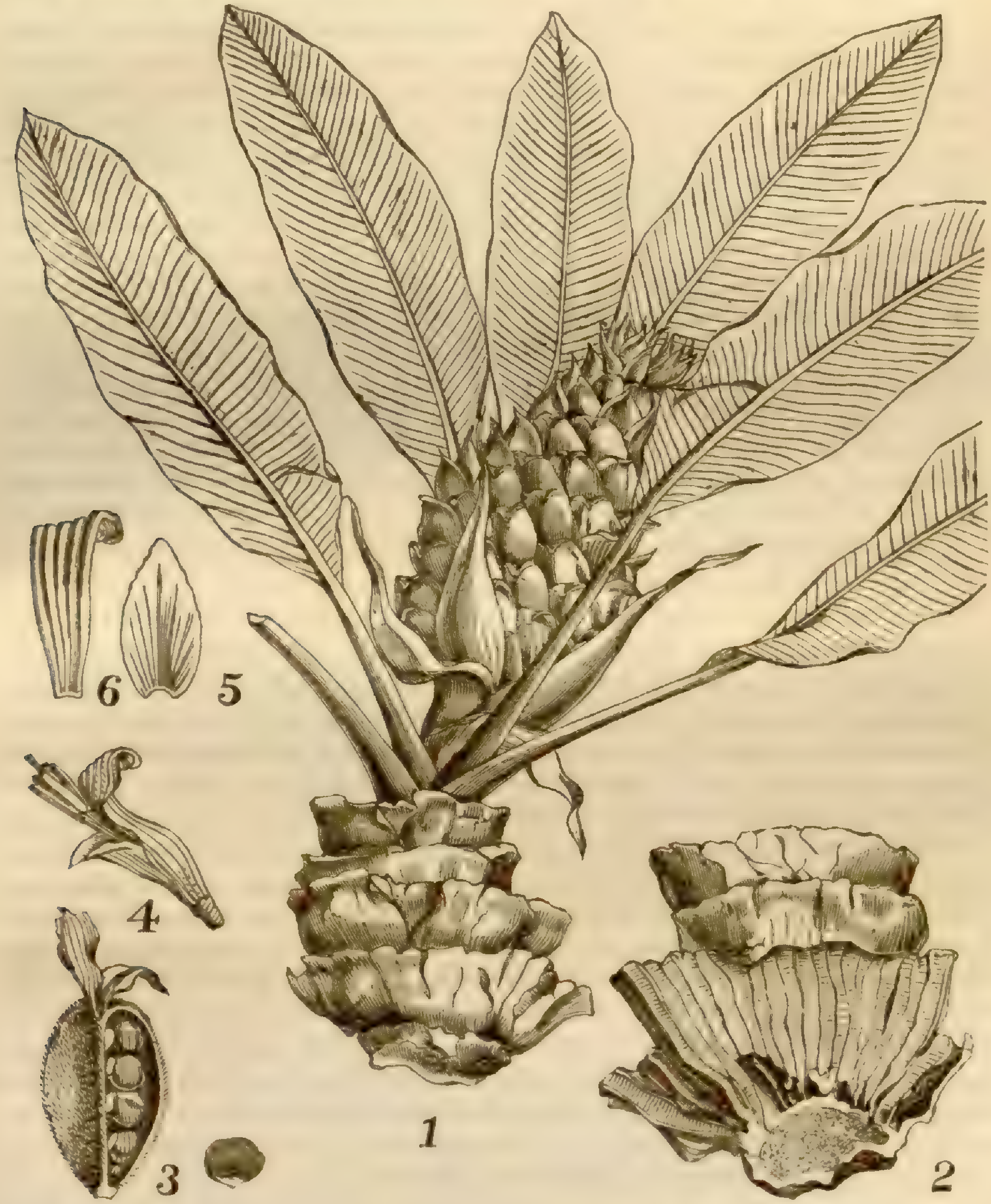
drum (1875). A fibre from "Jungle plantain (*M. superba*)" is shown from Mangalore, the chief town of South Kanara, in the Madras Presidency, and from the Botanic Gardens, Mauritius, Col.-Ind. Exhibition, 1886.

7. **M. nepalensis,** *Wall.* This is principally known from two large unpublished drawings by Wallich now at Kew. It is not anywhere in cultivation. Dr. King, F.R.S., in a letter dated Calcutta 22nd August 1893, writes:—"I do not believe in the existence of the species which Wallich called *M. nepalensis.* I have never been able to hear of, or find, any specimens of a big non-stoloniferous plantain on the lower slopes of the Himalaya. I have made inquiries in Nepal where Wallich says it grows. Wallich must have described Roxburgh's *M. glauca* under the name *nepalensis.*"

Subgenus Eumusa.

True Musas.

8. **M. lasiocarpa,** *Franchet.* A singular species only about 1–2 feet high, known by the Chinese of Yunnan as *Ngay-tsiao* (Rock banana).



Musa lasiocarpa, Franchet.

1. Whole plant (2 feet high) much reduced. 2. Section of rhizome surmounted by persistent portions of leaf-sheaths. 3. Fruit with seeds. 4. Flower. 5. Calyx. 6. Petal.

The rhizome is 2–3 inches in diameter and crowned with successive frills of the lower persistent leaf-sheath. The small petioled leaves rise almost directly from the ground. The spike is erect, very dense, with prominent bracts. The fruit is dry, pubescent on the outside, hence the name, and contains 4–6 seeds. This interesting plant is regarded by Franchet as the type of a new section called *Musella.* It is remarkable for the absence of a stem, the pubescent character of its fruit, the dense form of the inflorescence, the persistency of all the bracts, and the complete absence of pulp in the fruit. The Abbé Delavay discovered the plant in 1885 in the mountainous regions of Yunnan on the rocks of Loko-chan and Che-tong near Tapin-tze, at an elevation of 4,000 feet. He states that it is easy of cultivation, and he has grown it in his garden for four years, but had not flowered it. *Journ. de Bot.*, vol. iii. (1889), pp. 329–331.

*9. **M. Cavendishii,** *Lamb.* M. chinensis, *Sweet* (name only); North Gallery, Nos. 225, 816; M. sinensis, *Sagot.* Stoloniferous. Whole plant 4–6 feet high; leaves 6–8 inches in a dense rosette, spreading, oblong, 2–3 feet long, about a foot broad, much rounded at the base, rather glaucous; petiole short, stout, deeply channelled, with two broad crisped green edges. Rachis short, stout. Spike dense, oblong, 1–2 feet long, drooping; bracts red-brown or dark brown, ovate, the lower 6 inches long, the upper 3–4 inches; male flowers and their bracts persistent. Petal ovate, entire. Fruit as many as 200–250 to a panicle, oblong, 6-angled, slightly curved, 4–5 inches long, above 1½ inches diameter, obtuse, narrowed gradually to the sessile base, seedless, edible, with a rather thick skin and delicate fragrant flesh. *Distribution:*—Native of Southern China. Cultivated in Mauritius, and introduced to England in 1827. This is now extensively cultivated in all tropical and sub-tropical countries and known as the "Chinese or Dwarf" banana. It furnishes a large proportion of the bananas usually sold in this country. The wild seed-bearing form is not yet known. *M. Massoni*, Sagot (name only) supposed to be wild at the Gaboon and cultivated in Bourbon, is said to be like *M. Cavendishii*, but with slightly different fruit. The interesting story of the introduction ot the Chinese banana to the islands of Polynesia is thus told by Seemann (*Flora Vitiensis*, p. 289):—

"An important addition to their stock of bananas the Fijians received in the *Vudi ni papalagi* (*i.e.*, foreign banana), our *Musa chinensis* or *Cavendishii*, which the late John Williams, better known as the Martyr of Eromanga, brought in a wardian case from the Duke of Devonshire's seat at Chatsworth to the Samoan or Navigator Islands, whence again, in 1848, the Rev. George Pritchard carried it to the Tongan or Friendly Islands, as well as to the Fijis. Its introduction has put an effectual stop to those famines which previously to this event were occasionally experienced in some of these islands. Never attaining any greater height than 6 feet, and being of robust growth, the Cavendish banana is but little affected by the violent winds which cause such damage amongst plantations of the taller kinds of *Musa;* and this advantage, coupled with its abundant yield and the fine flavour of its fruit, have induced the natives to propagate it to such an extent that, notwithstanding its comparatively recent introduction, the *Vudi ni papalagi* numbers amongst the most common bananas of the country." A sample of fibre from the stem of *M. Cavendishii* is in the Kew Museum, from Jamaica, prepared by Nathaniel Wilson.

10. **M. nana,** *Lour.* Trunk cylindrical, 5 feet long, ½ foot diameter, leaves oblong-ovate, 3 feet high; spike short, recurved; flowers all

fertile. Stamens often six or more. Fruit ovate-oblong, edible, seedless. According to Loureiro this is a native of Cochin-China, where it is called *Chuoi duii.* It is, however, unknown to M. Pierre. Mr. Baker thinks it may be a form of *M. Cavendishii*, Lamb, with a taller stem and staminate flowers abortive. *M. Rhinozerotis*, of Kurz, said to be like *M. nana*, but with all the sheaths of the leaves enveloping one another, and with persistent bracts and flowers all fertile, is unknown at Kew.

11. **M. glauca,** *Roxb.* Not stoloniferous. Trunk cylindrical, 10–12 feet high, 6–8 inches diameter. Leaves oblong-lanceolate, acute, 4–5 feet long, pale and glaucous; shortly petioled. Spike drooping from the base ; bracts greenish, persistent. Fruit oblong, 4–5 inches long, 1½ inches diameter ; truncate at the apex, narrowed gradually to the sessile base. Seeds smooth, globose, nearly black, ½-inch diameter. Pegu ; introduced to the Calcutta Botanical Garden by Mr. F. Carey in 1810. This has flowers like *M. superba*, and a cylindrical trunk like *M. sapientum.* Roxburgh in his *Coromandel Plants*, iii. 96, adds, "Like my *M. superba* it never produces suckers, consequently it must be reared from seed, which it furnishes in great abundance ; the fruit containing little else, even fit for a monkey to eat."

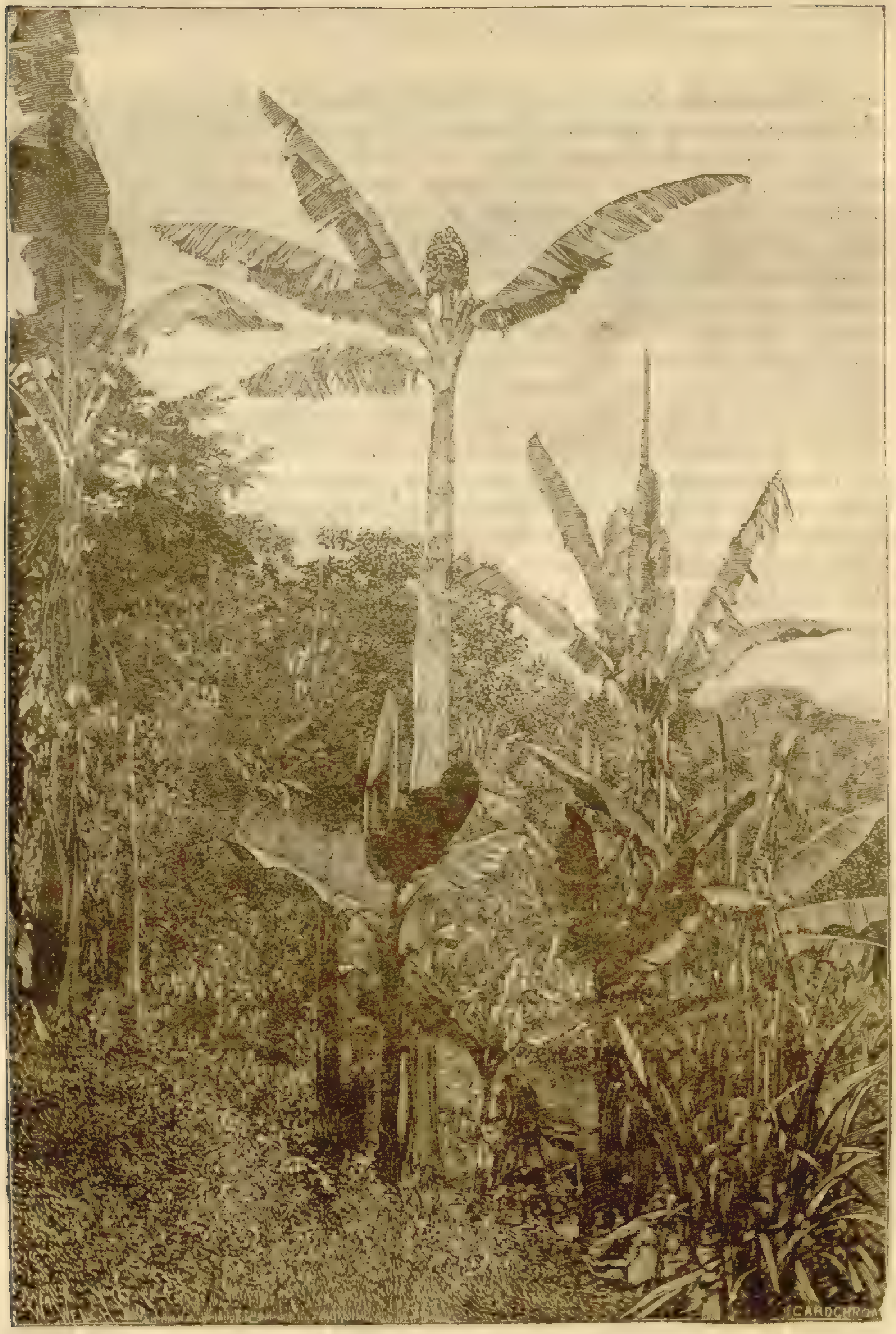
12. **M. acuminata,** *Colla* (M. simiarum, *Rumph*) ; M. rumphiana, *Kurz.* Stem high, cylindrical, stoloniferous at the base. Leaves oblong, 5–6 feet long, glaucous beneath, deltoid at the base, firmer than those of *M. sapientum ;* petiole 1–1½ feet long, almost without any membranous edge. Spike drooping, shorter than the leaves ; male flowers deciduous ; bracts lanceolate or oblong-lanceolate, violet, only one of those of the female flowers opened at once and revolute, those of the male clusters involute at the edge. Calyx white or yellowish, 1–1¼ inches long ; petal ovate-acuminate, nearly as long as the calyx. Fruit in 4–6 clusters of 10–12 each, oblong, rostrate, 2–4 inches long, 1–1½ inches diameter ; skin not easily peeled off ; flesh sweet. Seeds dull black, angled by pressure, ⅙ inch diameter. *Distribution :*—Common in Java and the other Malay Islands extending eastward to New Guinea. Kurz, who studied this species carefully on the spot, says that a large proportion of the bananas which are cultivated in the Malay Archipelago are derived from it, and that its best varieties are superior to all those derived from *M. sapientum* in quality and delicacy. Typical *M. acuminata* is wild and has fruit full of seed. From this several seedless cultivated varieties are derived, differing in the colour of the leaves and fruit. They all have the leaves glaucous beneath, and in one form the waxy bloom is so copious that torches are made from it. Var. *violacea*, Kurz, has its stems, leaves, and flowers more or less tinged with dark purple, and purple 3–5 angled fruit with a thick beak. Its native name is "pisang teembaya" or "pisang hoorang" (copper or crab plantain). Var. *culta*, Kurz, is larger in all its parts, with much larger whitish or yellowish flowers, and longer cylindrical or angled yellow or greenish seedless fruit. Of this there are 48 distinguishable forms, of which the most curious is the Duck plantain ("pisang moolook bebbek"), the fruit of which has a beak nearly as long as its body. Baker refers here *M. paradisiaca*, Zollinger. Probably *M. Berterii*, Colla (M. alphurica, *Rumph*), which has green and leaf-like lower bracts and pale yellow ripe fruit a span long, is a variety of this species. Nothing is known of *M. Karang*, Kurz, of which the fruit is said to be angular, short, and thick-beaked, and the bracts yellow inside.

13. **M. corniculata** (*Rumph. Amboin.* V. 130), *Lour. Fl. Cochinch.* 644; native name in Cochin-China, *Chuoi boi.* Stem cylindrical, 10–12 feet high, as thick as the human thigh. Leaves oblong, green, 5–6 feet long; petiole 1–1½ feet long. Spike drooping, only the 2–3, rarely 4 lower bracts and flower whorls developed, the former oblong-lanceolate, a foot long. Calyx deeply five-toothed. Petal ovate-acuminate, nearly as long as the calyx. Fruit cylindrical, a foot or more long, 1½–2½ inches diameter, narrowed gradually to the apex and sessile base, golden-yellow when ripe; skin thick; pulp reddish-white, firm, dry, sweet, very palatable when cooked. *Distribution:*—Malay Islands and Cochin China. Kurz compares the fruit to a cucumber as regards shape and size and describes five varieties, but considers it to be probably only an extreme form of *M. acuminata.* A curious form is the Lubang variety, of which the stem is said to produce only a single fruit large enough for a full meal for three men.

*14. **M. Hillii**, *F. Muell.* Not stoloniferous. Stem robust, about 30 feet high and a diameter of 1½ feet. Leaves similar to *M. sapientum.* Spike dense, erect. Fruit densely crowded, not edible. Seeds numerous, angled, much depressed, ⅕–⅓ inch diameter, with a bony testa. *Distribution:*—Queensland, banks of the Daintree river, with the two species following. A plant at Kew resembles *M. Troglodytarum*, Linn. No doubt this is *M. Jackeyi*, Kurz, l.c. This species has lately flowered at Kew and a description with plate prepared for the *Botanical Magazine.*

*15. **M. Fehi**, *Bertero;* M. Fei, *Nadeaud.* Stoloniferous. Trunk cylindrical, 15–20 feet high, greenish, full of violet juice. Leaves larger and firmer in texture than in *M. sapientum* and *paradisiaca*, with stouter veins; midrib green; base unequally rounded; petiole 1–1½ feet long. Spike long, erect, slightly curved only at the base. Flowers 6–8 in a cluster, sessile. Calyx with 5 unequal lobes, split finally nearly to the base. Petal short. Fruit many in a bunch, oblong, angled 5–6 inches long by above an inch in diameter, nearly straight, yellow when ripe, with a thick skin and moderately firm pulp, not very palatable when raw, but excellent when cooked. Seeds small, dull black. *Distribution:*—Common in the forests of Tahiti, where it is largely used for food, seedless at the low levels, but occasionally bearing seeds at an altitude of 3,000–3,600 feet. Native name *Fei.* Found also sparingly by Vieillard in New Caledonia, there called *Daak.* We have young plants at the present time in the Kew collection. Probably the Fijian *M. Seemanni*, F. Muell, of which a photograph, sent by Sir John Thurston, is reproduced here from *Gard. Chron.*, 1890 [2], 182, fig. 28, is the same species. This is *M. Uranoscopos*, Seem., and *M. Troglodytarum*, Kurz (in part). We have also leaves from the Rev. T. Powell of a plant from Samoa called "Laufoo," which probably belongs here. An interesting account of the seedless and seed-bearing forms of *M. Fehi* is given by Dr. Sagot in *Bull. Soc. Botanique de France*, xxxiii., pp. 317--326.

16. **M. Banksii**, *F. Muell;* M. banksiana, *Kurz.* Stoloniferous, with trunk like that of *M. sapientum.* Spike drooping. Fruit quite cylindrical when dry, without any angle, narrowed suddenly to a slender stipe 1½–2 inches long. Seeds grey, sub-globose, ⅙ inch diam., angled in the lower half. *Distribution:*—Queensland, Mount Elliot and Rockingham Bay. Very like *M. sapientum* in stem and leaf, but totally different in fruit. It yields a fibre of poor quality. A sample received from Mr. W. R. Guilfoyle, F.L.S., is in the Kew Museum, where the fruit (from Sir F. von Mueller) and seeds (from Mr. L. A. Bernays, C.M.G.) are also shown.



Musa Fehi, Bertero.
From *Gardeners' Chronicle*, 1890 [2], fig. 28.

17. **M. Fitzalani,** *F. Muell.* Stem 20 feet high. Leaves patent. Spike drooping. Fruit oblong, angled, yellow when ripe, not pulpy, 2–3 inches long, narrowed suddenly to a thick stipe about $\frac{1}{2}$ inch long. Seeds numerous, filling the cells, angular, depressed, scarcely $\frac{1}{6}$ inch in diameter. Queensland. *M. Charlioi*, Walter Hill, in Report of the

Brisbane Garden, 1874, is said to have stems 40–50 feet high, leaves 5–6 feet long, and fruit 3–4 inches long.

*18. **M. textilis**, *Née ;* (M. mindanensis, *Rumph*)*;* M. sylvestris, *Colla;* M. Troglodytarum textoria, *Blanco.* Stem cylindrical, green, 20 feet or more high, stoloniferous from the base. Leaves oblong, deltoid at the base, bright green above, rather glaucous beneath, smaller and firmer in texture than those of *M. sapientum ;* petiole a foot long. Spike drooping, shorter than the leaves ; male flowers deciduous ; bracts firmer in texture than those of *M. sapientum*, naked and polished outside, not at all pruinose, brown. Female flowers in several laxly-disposed clusters. Fruit green, oblong trigonous, curved, 2–3 inches long, 1 inch diameter, not narrowed to the apex, but narrowed to the short stout stipe, not edible, but filled with seed. Seeds black, turbinate, ⅙ inch diameter, angled by pressure. *Distribution :*—Widely distributed and cultivated in the Philippine Islands under the name of *Abaca.* It ascends the mountains in the wild state to the lower limit of *Pinus insularis.* It is cultivated (at elevations of 200 feet to 500 feet) for the sake of its cordage fibre, one of the most valuable known for the manufacture of white ropes. The plant has been introduced to other tropical countries, but, so far, it has not succeeded anywhere so well as in the Philippines. (*Kew Bull.*, 1887, April, pp. 1–3.)

Var. *M. amboinensis*, Rumph. Stem not so tall. Spike not so drooping. Fruit as long as a man's finger, black at maturity. Native of Amboyna.

A very complete set of specimens of fruit (Ceylon), seeds (Manila), of prepared hemp, cords, ropes, mats, plaited work, hats, lace handkerchiefs from *M. textilis* are shown in the Kew Museum. Dried specimens of the inflorescence of this species are desired for the Kew Herbarium ; while a portion of the spike preserved in spirit would be a valuable addition to the Museum.

*19. **M. discolor**, *Horan.* Stoloniferous. Stem slender, cylindrical, 6–10 feet high. Leaves narrow-oblong, smaller and firmer in texture than in *M. sapientum*, rounded at the base, glaucous, tinged with violet or red beneath when young ; petiole a foot or more long. Spike drooping, finally as long as the leaves ; bracts reddish, the upper only persisting ; male flowers deciduous. Fruit cylindrical, angled, rather curved, umbonate at the apex, rather dry, reddish-violet, very palatable, with a violet pulp, and a rather musky scent. *Distribution :*—This species is cultivated in Polynesia and especially in New Caledonia, where it bears the name of *Colaboute*, and is said by Vieillard to be wild there. It produces no fertile seeds. It is in cultivation in this country and there is a drawing at Kew by Fitch of a plant that flowered in the Gardens many years ago. The stem yields a textile fibre which is used for fish-baskets, &c.

*20. **M. Basjoo**, *Sieb.* et *Zucc.; Bot. Mag.* t. 7182 ; M. japonica *Hort.* Stoloniferous. Stem cylindrical, 6–9 feet high, 6–8 inches diameter. Leaves oblong, thin, bright green, 6–9 feet long, 1½–2½ feet broad, deltoid at the base ; petiole stout, about a foot long. Rachis stout, arcuate, a foot long. Spike dense, 1–1½ feet long ; female clusters 3–4, close, of 12–15 flowers each; bracts oblong, dull brown, the lower 8–12 inches long; male clusters 8–12, their bracts much imbricated, persistent. Calyx whitish, 2 inches long, shortly five-toothed at the tip. Fruit oblong-trigonous 3 inches long, umbonate at the apex, narrowed gradually to the sessile base. Seeds not seen. *Distribution :*—Liu Kiu archipelago (25° to 30° N. lat.); cultivated in Southern Japan. Introduced into cultivation in England by Messrs. Veitch of Chelsea. Described from a plant that flowered in the Temperate House at Kew in 1891. It is said to be as hardy as *M. Ensete.* It is grown in Southern Japan for its fibre. An interesting series of articles made from this "Japanese plantain," consisting of fibre, cloth and other fabrics, is in the Kew Museum, presented by Mr. J. H. Veitch, F.L.S. The cloth is used for making screens, and for binding books.

**M. Martini,* Rev. Hort. Belg. 1892, 107, fig. 12, has the habit of *M. sapientum,* and is said to be more hardy than *M. Ensete,* with bright rose-red flowers. The leaves are oblong, long petioled, firm in texture, bright green above, glaucous beneath with reddish veins. A plant which has not yet flowered exists in the Kew collections brought from the Botanical Garden, Orotava, Teneriffe, by the Assistant Director in 1893.

21. **M. malaccensis,** *Ridley.* Stems few, slender, 6 inches diameter, with purple-brown blotches. Leaves about 8 feet long, green with brown bars. Spike drooping clothed with brown hairs; bracts lanceolate, sub-acute, brown, outside glaucous, inside striped with yellow. Female flowers 16 in a bract in a double row. Fruit sub-cylindrical, somewhat angular, 4 inches long, an inch wide; seeds black, angular; "pisang karok" of the Malays. *Distribution :*—Common in the jungles of Malacca, Selangor, and Perak, occurring also in Pahang.

"*M. zebrina* (Flore des Serres, t. 1061, 1062) is doubtless," according to Ridley, "a young plant either of this species or of *M. sumatrana,*Becc. I never saw" he says "any form of *M. sapientum,* L. (to which species Mr. Baker refers this) with barred leaves. The brown bars are very constant in young plants of *M. malaccensis* and even persist sometimes in the adult foliage. This species may perhaps be the parent of some of the cultivated bananas here, but is very distinct from *M. sapientum* in the hairy rachis and other points . . . An attempt has been made to utilise the fibre. The plant is very abundant and springs up like a weed when old jungle is felled and forms an impenetrable thicket."

22. **M. flava,** *Ridley.* Leaves 16 inches wide, green. Spike nodding, pubescent; bracts widely ovate-lanceolate, obtuse, 4 inches long, 1½ inches wide, yellow. Female flowers 16 to a bract in two rows. Fruit, when dry, 2 inches long, five-angled. *Distribution :*—Eastern coast of the Malay Peninsula, Pahang at Pulau Tijau on the Pahang River.

Nearly allied to *M. malaccensis,* but the broad, thick, blunt, bright yellow bracts give it a totally different appearance, the spike being quite blunt at the top.

* **Musa** sp. Hongkong. No. 467, 1886. A plant of a *Musa,* native of Hongkong, supposed to be new, was received from Mr. Charles Ford, F.L.S., in 1886 and again in 1894. It is now growing at

Kew but it has not yet flowered. It has a slender stem and rather small leaves. The flowers, judging by dried specimens, are those of *M. sapientum.*

*23. **M. sapientum,** *Linn. Sp. Plant.* 1477 ; *Trew, Ehret.* t. 21–22. Stem cylindrical, usually green, reaching a height of 20–25 feet, 4–10 inches diameter, stoloniferous from the base. Leaves oblong, thin, bright green, 5–8 feet long, 1½–2 feet broad, usually rounded at the base ; petiole 1–1½ feet long. Spike drooping, often 4–5 feet long ; male flowers deciduous ; bracts lanceolate or oblong-lanceolate, dull violet, more or less glaucous outside, the lower 1–1½ feet long, the upper ½ foot, often red inside, several expanded at once, the edges of the upper not involute. Flowers about a dozen to a cluster, yellowish-white, 1½ inches long ; calyx five-toothed at the top ; petal ovate, half as long as the calyx. Fruit oblong-trigonous, 3–8 inches long, 1½–2 inches diameter, forming three to nine bundles of about a dozen each, rounded to the apex, narrowed gradually to the sessile base, yellow or bright yellow or reddish when ripe, the flesh fit to eat without cooking. Common banana. Universally cultivated throughout the tropical zone of both hemispheres for the sake of its fruit. It also yields a fibre, which, however, is much inferior in tenacity to that of *M. textilis.*

One of the original forms of this is probably the wild *M. sapientum* mentioned by Roxburgh (*Corom. Pt.* t. 275) as grown from seed received from Chittagong.

*Var. *M. paradisiaca,* Linn. Sp. Plant. 1477 ; Trew, Ehret, t. 18–20. Male flowers and bracts less deciduous. Fruit cylindrical, ½–1 foot long, generally yellow or yellowish green when ripe with firmer and less saccharine pulp, not fit to eat without cooking. Common plantain. Cultivated universally in the tropical zone.

Var. *M. Troglodytarum,* Linn. ; M. Uranoscopos, *Rumph.* Fruit small, crowded on the erect axis of the panicle, obovoid-oblong or nearly round, reddish-yellow, containing rudimentary seeds. Flesh sweet, yellow. Wild in India, Ceylon (Moon), and the Malay Isles, the favourite food of elephants. The above names have often been applied to forms of other species than *sapientum,* with a similar habit, such as *M. Fehi.*

Var *M. oleracea,* Vieill. A flowerless form with a glaucous violet stem and an elongated thick turnip-like rhizome, which is boiled or roasted like a yam, which it resembles in taste. New Caledonia. Native name *Poiete.*

*Var. *M. vittata,* Hook. in *Bot. Mag.* t. 5402 ; M. vittata, *Ackerm.* in *Flore des Serres,* t. 1510–1513. Leaves and long fruits copiously striped with white. Spathes bright red inside. Imported from the island of St. Thomas, West Africa.

Other varieties to which Latin names have been given are : *M. violacea,* Hort ; *M. sanguinea,* Welw. ; *M. odorata,* Lour. ; (*M. mensaria,* Rumph) ; (*M. regia,* Rumph) ; * M. champa, Hort. ; * *M. martabanica,* Hort. ; * *M. dacca,* Horan. ; * *M. rubra,* Firminger, non Wallich.

W. Fitch, del. et lith.

Musa sapientum var. *vittata*, Hook. f.
(*Botanical Magazine*, t. 5402.)

1. Plant in fruit reduced. 2. Bract and hermaphrodite flowers. 3. Unripe fruit. 4. Transverse section of same.

PLANTAIN AND BANANA.

The sweet bananas by many authors are referred to *Musa sapientum* and the vegetable-like fruits or plantains to *M. paradisiaca.* There are, however, no characters that can be clearly defined as separating the two. Roxburgh, who paid particular attention to both the native and cultivated bananas and plantains of India, pronounces both to be varieties of one species found wild in the hilly districts of East Bengal, and which he calls *M. sapientum.* R. Brown (Tuckey's *Congo*, App. 471) states "there is no circumstance in the structure of any of the states of the banana or plantain cultivated in India or the islands of equinoctial Asia to prevent their being all considered as merely varieties of one and the same species, namely, *Musa sapientum ;* that their reduction to a single species is even confirmed by the multitude of varieties that exist ; by nearly the whole of these varieties being destitute of seeds ; and by the existence of a plant indigenous to the continent of India producing perfect seeds ; from which, therefore, all of them may be supposed to have sprung." Loureiro (*Fl. Coch.* 792) says the same thing; as does Desvaux (*Journ. de Bot.* (1814) Vol. IV. p. 5). Sir William Hooker (*Bot. Mag.* tab. 5402) states that the flowers of the bananas and plantains cultivated at Kew afford no character to distinguish them.

As to question of origin, A. de Candolle, following R. Brown, is of opinion that all evidence hitherto available points to "a primitive existence in Asia, and to a diffusion contemporary with or even anterior to that of the human race."

Alphonse de Candolle (*Cult. Plants*, pp. 306–308) discusses the origin and distribution of the banana as follows :—

"The antiquity and wild character of the banana in Asia are incontestable facts. There are several Sanskrit names. The Greeks, Latins, and Arabs have mentioned it as a remarkable Indian fruit tree. Pliny speaks of it distinctly. He says that the Greeks of the expedition of Alexander saw it in India, and he quotes the name *pala* which still persists in Malabar. Sages reposed beneath its shade and ate of its fruit. Hence the botanical name *Musa sapientum.* Musa is from the Arabic *mouz* or *mouwz*, which we find as early as the thirteenth century in Ebu Baithar. The specific name *paradisiaca* comes from the ridiculous hypothesis which made the banana figure in the story of Eve and of Paradise."

Again, "there is an immense number of varieties of the banana in the south of Asia, both on the islands and on the continent ; the cultivation of these varieties dates in India, in China, and in the Archipelago, from an epoch impossible to realise ; it even spread formerly into the islands of the Pacific, and to the west coast of Africa ; lastly, the varieties bore distinct names in the most separate Asiatic languages, such as Chinese, Sanskrit, and Malay."

The probable introduction to eastern tropical America is thus summed up :—

"The culture of the banana may be said to be recent in the greater part of America, for it dates but from little more than three centuries. Piso says positively that it was imported into Brazil, and has no Brazilian name. He does not say whence it came. According to Oviedo, the species was brought to San Domingo from the Canaries. This fact and the silence of Hernandez, generally so accurate about the useful plants, wild or cultivated, in Mexico, convince me that at the time of the discovery of America the banana did not exist in the whole of the eastern part of the continent."

At the present time the plantain and banana are extensively cultivated in the tropics of the New World, and they have become as conspicuous a feature in the landscape as in the Old World, freely propagating by suckers and often found half wild in the forests.

With regard to Polynesia, Seemann remarks (*Flora Vitiensis*, p. 288) that "a great many different kinds of *Musa* were found established in different parts of cultivated Polynesia, when Europeans first became familiar with them. In Tahiti alone, Banks and Solander saw 28."

Sagot states that the wild banana most allied to the cultivated, and from which, therefore, it may be presumed to have originated, has the same height and habit. The spike is pendent towards the earth; the fruits are smaller, more distant one from another, and contain several fertile seeds. It also produces offsets from its rootstock. It occurs in some of the forests of India, notably at Chittagong (Roxburgh, *Fl. Ind.* i. 663), in Ceylon (Thwaites' *Enum.*, p. 321), in Cochin China, Siam especially, in the small island of Pulo Ubi (Finlayson), in the Philippines (Rumph and Blanco). Sagot adds: "I am unable to say if it is the same plant that is scattered over this vast area, or if there are several distinct species belonging respectively to the different countries."

In some countries, as in India, Ceylon, Mauritius, and Cochin China, bananas are cultivated with fruits containing several fertile seeds, which appear to belong to a wild form as yet slightly modified by cultivation.

The BANANA or SWEET PLANTAIN (*Musa sapientum*, Linn.). This is the sweet fruit used without cooking, it has various names in different parts of the world. The old voyagers called it "bonano." In the time of Roxburgh the Hindu or Bengali name for the banana was "kulla." Usually amongst Europeans in India the word "plantain" is used in a general sense for both the banana and plantain. Latterly, however, even in India, a distinction has been made in regard to the size and delicacy of the fruit, the small being the banana and the large the plantain. The Spaniards of tropical America call the banana "bacove," "bacooba," or "pacooba," while in other Spanish countries varieties of the banana are known as "cambur," or "camburi," or "platano guineo." The English in the West Indies call the small and delicate bananas "fig-bananas," or simply "figs." The French call the banana "bananes des sages," or "figue banane." In the Malay Archipelago, *pisang*, always translated "plantain," is used for both bananas and plantains. The variety known as "pisang maas," or the golden pisang, appears to come nearest to the banana as known elsewhere.

One of the earliest accounts of the banana and plantain is given by Ligon in his *History of Barbados*, published in 1657. In this work there are two wood cuts, drawn, as the author states, "by memory only," showing the habits of the two plants and the fruit. Of the "bonano" he says "it is of sweeter taste than the 'plantine,' and for that reason the negroes will not meddle with it, for it is not so useful a food."

Dampier's description, published in his *Voyages*, some years later, is more exact:—

"The *bonano* tree is like the plantain for shape and bigness, nor easily distinguishable from it but by its fruit, which is a great deal smaller, and not above half so long as a plantain, being also more mellow and soft, less luscious, yet of a more delicate taste. They use this for the making drink oftener than the plantains, and it is best when used for drink, or eaten as fruit; but it is not so good for bread, nor doth it eat well at all when roasted or boiled, so 'tis only necessity that makes any use it this way."

Rochefort (*Hist. Nat. des Isles Antilles*, pp. 90–93, ed. 1658) refers to the banana as *la figue*. It describes it as "only half the size of the plantain, and usually about 6 inches long. The tree bears 100 to 126 fruits, which are so closely packed that they press upon one another."

Lunan, in 1814, introduces a distinction first noticed by Ligon that the stem of the banana "has here and there some blackish spots." He says:—

"The banana tree so much resembles the plantain as hardly to be distinguished at first sight, but has its stem irregularly marked with black or dark purple spots, which the other has not. The bunches of fruit are more compact, and the fruit more numerous, shorter, and rounder, than that of the plantain. The fruit has also a thinner skin, and the pulp is softer and of a more luscious agreeable taste when ripe, which may be eaten either raw, fried, or boiled, and makes excellent fritters. It is a delicate food when ripe and roasted with the skin on."

Grisebach, in the *Flora of the British West India Islands*, p. 599, describes the stem of the *M. sapientum* as "purple-spotted," and the fruit 5 to 6 inches long. Sir William Hooker, judging from plants grown at Kew, believed the leaves of the banana to be more rounded or cordate than those of the plantain. A further distinction often cited is the fact that the male flowers and bracts are deciduous in the banana leaving the spike beyond the fruit usually naked. In the plantain the male flowers and the bracts are persistent, and the spike beyond the fruit is clothed, not naked. The chief distinction, however, dwelt upon is the difference in the character of the fruit. This in the banana is always sweet when ripe, and it is fit to eat without cooking. Further, some sorts of banana are found to bear a cooler climate than the plantain.

The PLANTAIN OR COOKING BANANA (*Musa sapientum* var. *paradisiaca*). This was recognised by Roxburgh under the Hindu and Bengali name of "katch kulla." It is the "large or cooking plantain" of Europeans in India, the Spanish "platano arton," the "banane" of French Guiana and Surinam, according to Aublet; while Rochefort, already cited, speaks of it as "le bananier." He adds, "It is 12 to 13 inches long and nearly as thick as the arm. The tree bears only 25 to 30 fruits on the raceme and these are rather laxly placed. They have a hard and dry flesh fit only for cooking or for being roasted in ashes." It is the sort typically represented by the "pisang tandok" of the Malays. Ligon in 1657 called it "plantine." This shows the antiquity of the common name amongst the English. Plantain was evidently originally derived from the Spanish name "plantano," altered by Joseph Acosta and subsequent writers into "platano." "Plantain," as remarked by Kurz, was an awkward introduction into the English language, as it was already applied to the common Rib-grass, a species of *Plantago*. Kurz, it may be added, contrary to general practice, in the East discarded the word "plantain" altogether, and in his writings used the word "banana" exclusively, for the edible fruit of Musas.

Grisebach describes the stem of the plantain as "green" and the fruits "ascending" (or curved upwards) "about a foot long." This curving upwards is characteristic of the Horn plantain, but it is not distinctive enough to separate plantains and bananas in general. The prevailing habit of the leaves, according to Sir William Hooker, is that they are "much longer and narrowed into the petiole" than in the banana. The male flowers and the bracts are not so deciduous as in the banana, and the portion of the spike beyond the fruit is much shorter and usually covered with the remains of the bracts and dried up flowers. The individual fruits again are very distinct. They have a firmer and less saccharine pulp and are not fit to eat without cooking.

In a "Report on the Agricultural Work in the Botanical Gardens, British Guiana," for the year 1890, pp. 59–60, Messrs. Harrison and Jenman state that it is only after a long and well-trained experience can the plantain be distinguished in the field from the banana when not in flower or fruit.

"When in fruit, however, the case is different. There is then a character, observable at sight, which only requires to be pointed out for the merest novice in the subject to be able to tell which is which. This character is that, in the banana, after the fruit has set and begun to develop, the succeeding clusters of flowers, often a hundred or more in number, and their large embracing bracts are deciduous, *i.e.*, drop away, leaving a clear absolutely naked, long extended and still elongating, stem or axis, hanging tail-like 2–3 feet beyond the fruit, with the firmly compacted mass of unopened bracts and flowers, bud-like at the end; while in the plantain the stem ceases to extend more than 12 or 18 inches beyond the fruit, the succeeding clusters of flowers and bracts all opening to the very end, and remaining persistent, withered and dry—the trash as it is called in colonial phraseology—being permanently attached to the stem. In the banana the axis continues to grow as long as the fruit hangs, cluster after cluster of flowers, with their bracts, opening and dropping away, a mass, like an enlarged *Nelumbium* bud, still unopened, remaining at the far extended end when the bunch is cut; while in the plantain the growth of the axis is arrested soon after the fruit sets, the abortive flowers opening, and remaining attached, from end to end of the stem."

"A single exception to the rule obtains in the case of the dwarf or Chinese banana (*Musa Cavendishii*), in other respects also specifically distinct, in which, as in plantains, the abortive flowers and their bracts are constantly persistent. Remembering this exception, and guarded from chance of mistake thereby, the untrained observer, seeing growing plants in fruit, may confidently determine which are plantains and which bananas, without attempting to assay the qualities of the fruit, upon which the great economic distinction above noticed is based. As mentioned before in the remarks on bananas, the texture of the plantain is such that at whatever stage it is used, whether green or ripe, it must be cooked to make it palatable. It is this quality in the plantain which makes the great economic difference between the two fruits."

M. sapientum and *M. paradisiaca* were described by Linnæus from cultivated and seedless specimens. Gaertner, however, pointed out that the distinction between seedless and seed-bearing plants was valueless. The identification of the original wild forms of all the numerous varieties of bananas and plaintains, now under cultivation, is probably impossible. Within certain well-defined areas, such as those of Ceylon, Eastern India, Burma, Siam, Cochin China, Indian Archipelago, and Polynesia, where the wild forms and the cultivated varieties are growing almost side by side, the work of cultivation is, and has been, carried on to a considerable extent.

Allied, if not identical, with *M. sapientum*, the following seed-bearing forms have been described :—***M. seminifera***, Lour. Fl. Cochinch, 644 ; M. sapientum, ***Roxb. Corom. Pl.*** t. 275 ; M. sapientum and Troglodytarum, *Gaertn. Fruct.* t. 11 ; M. balbisiana, *Colla, Monogr. Musa*, 56 (Rumph Amboin., t. 60, fig. 3). The fruit is small, oblong, full of seeds, not eatable, yellowish or greenish.

The Chittagong plant, figured by Roxburgh, grows in very soft soil, and has tall lanky stems. Kurz distinguishes two species, *M. sapientum*, with bracts often crimson inside, seeds turbinate-globular to polyhedrous, tubercled, not above $\frac{1}{6}$ inch diameter, and *M. sikkimensis*, with dull purple bracts and seeds depressed and irregularly angled, tubercled, 4–5 lines diameter. Of the latter, we have careful sketches made on the spot by Sir J. D. Hooker and it has been widely distributed as *Musa*, No. 5 of Hooker and Thomson's Indian plants. Pierre, in Sagot's monograph, describes in detail three forms from Cochin China.

Dr. King distinguishes four wild seminiferous forms in Sikkim as follows, viz. :—

1. *pruinosa* ("Reling" of the Lepchas). Stem, 10–25 feet high. Leaves very glaucous beneath, bracts deep violet-purple, glaucous outside, red inside, persistent, subtending the fruit ; fruit about 5 inches long by $1\frac{1}{2}$ inches diameter, permanently angled, seeds $\frac{1}{4}$ inch diameter, pulp very scanty. Altitude, 1,500–3,500 feet. Seeds of this are in the Kew Museum, from Mr. J. S. Gamble, F.L.S.

2. *dubia* ("Luxon" of the Lepchas). Stem lower, leaves not glaucous beneath, bracts deep lurid purple, not glaucous outside, purplish-red inside, lower bracts deciduous ; fruit 3–4 inches long, $1–1\frac{1}{6}$ inch diameter, with prominent ribs, seeds $\frac{1}{4}–\frac{1}{3}$ inch diameter, pulp more copious. Altitude, 1,500–5,500 feet.

3. *Hookeri* ("Tiang-moo-foo-goon" of the Lepchas). Stem 10–14 feet high, tinged with red, leaves bright green on both sides, tinged with purple when young, bracts purple on both sides, glaucous outside, lower deciduous ; fruit 5–6 inches long, 2 inches diameter, prominently angled ; seeds 4–5 lines diameter, pulp scanty. Common, between 4,500 and 5,500 feet.

4. *Thomsoni* ("Kergel" of the Lepchas). Stem green, 12–15 feet high, leaves glaucous only when young, conspicuously cuspidated at the apex, bracts ovate outside, with vertical streaks of yellow

and purplish-brown, yellow inside; fruit 2½ inches long, ¾ inch diameter, faintly ribbed; seeds few, black, soft, ⅕ inch diameter, surrounded by copious sweet pulp. Does not rise above 1,500 feet.

Dr. King thinks the two latter forms are likely to be distinct specifically from *sapientum*. His *Hookeri* is probably *M. sikkimensis*, Kurz.

In the Kew Museum is a dried complete bunch of fruit marked *M. cliffortiana*, which, no doubt, represents the wild seminiferous state of *M. sapientum*. The fruits, densely crowded together in the spike are about 3 inches long, about ½ inch diameter, and completely filled with seeds. This specimen was presented to Kew by the late D. Hanbury, F.R.S., in 1867.

Sub-genus Rhodochlamys.

Red-bracteated Musas.

24. **M. maculata,** *Jacq.* Stem slender, 7–8 feet high. Leaves green above glaucous beneath; petiole ½ foot long. Bracts yellowish-brown; flowers four in a cluster. Fruit oblong, 2–3 inches long, 1 inch diameter, narrowed gradually to the sessile base and apex, yellow, spotted with brown, eatable, aromatic; flesh, white. Known only as cultivated in Mauritius and Bourbon, where it is called *Figue mignonne.* Differs from the other species of this sub-genus by its eatable fruit.

*25. **M. sumatrana,** *Beccari.* Whole plant 7–8 feet high. Stem. slender. Leaves glaucous with irregular blotches of claret-brown. Rachis hairy. Dried fruit cylindrical, curved, 2–3 inches long, ½ inch diam. *Distribution:*—Sumatra, province of Padang, alt. 1,100 feet, Beccari. Cultivated in India. Its affinity is with *M. rosacea*, Jacq. A sample of the fibre prepared from the stem of this species is in the Kew Museum from Mr. R. Derry, Malacca, 1889.

26. **M. violascens,** *Ridley.* Stem cylindrical slender, 8 to 10 feet high. Leaves glaucous beneath, 10 inches wide with a stout midrib. Spike erect or sub erect, having bracts narrowly lanceolate, acute. white tinged with purple-violet or wholly violet, 9 inches long by 2 inches wide or wider. Female flowers 6 in a bract. Fruit green, 3 inches long, an inch thick, angular; seeds ¼ inch long, not angular. *Distribution:*—Malay Peninsula, Pahang, Selangor, and Sungei Ujong. This plant is distinguished by its erect or almost erect spadix of which the bracts are remarkably long and narrow, acuminate and of a violet colour like that of a "brinjal." The flowers are few and arranged in single rows in each bract; sometimes the bracts are persistent after the flowers are fallen and hang down. The seeds are cylindrical and not angled and irregular as is the common banana and *M. malaccensis.* Although placed under the section *Rhodochlamys* the petal has the form of the section *Eumusa.*

*27. **M. rosacea,** *Jacq.* *Bot. Reg.* t. 706; *Lodd. Bot. Cab.* t. 616 M. ornata, *Roxb.*; M. speciosa, *Tenore*; M. Carolinæ, *Sterler.* Stoloniferous. Stem cylindrical, 3–5 feet high, 3–4 inches diameter. Spike drooping or erect; bracts pale blue or reddish-lilac. Fruit oblong, 2–3 inches long, but little pulp, scarcely edible. Seeds $\frac{1}{6}$ inch diameter black tubercled. *Distribution:*—Eastern Himalayas and hills of Concan. Flowered at Kew in 1881 and 1890. Introduced to Europe from Mauritius about 1805.

28. **M. salaccensis,** *Zolling.* Stem slender. Leaves thin oblong, Bracts pale lilac. Fruit oblong full of seed; latter dull brown $\frac{1}{6}$ inch diameter. *Distribution:*—Mountains of Java and Sumatra. Described from specimens in the Calcutta herbarium, dried by Kurz, from the Buitenzorg Garden. Closely allied to *M. rosacea.*

29. **M. velutina,** *Wendl.* and *Drude,* in *Regel. Gartenfl.*, 1875, 65, t. 823; M. dasycarpa, *Kurz.* Habit of *M. sanguinea.* Bracts bright red, pubescent on the outside. Calyx pale yellow. Fruit velvety, bright red. *Distribution:*—Throughout the forests of Assam (Mann). Introduced to cultivation in 1875. Differs from *sanguinea* and *aurantiaca* by its red pubescent fruit.

*30. **M. coccinea,** *Andr. Bot. Rep.* t. 47; *Bot. Mag.* t. 1559; North Gallery, No. 696. Stem stoloniferous, slender, finally 4–5 feet high. Rachis erect. Spike dense, erect; bracts bright red or tipped with yellow. Fruit oblong-trigonous, not edible. Seeds very small. *Distribution:*—Southern China and Cochin China. In the latter country it is called *Chuoi tau.* Introduced into cultivation in 1791 and now widely spread. Specimens of fibre prepared from this species are in the Kew Museum from Jamaica, prepared by Nathaniel Wilson, and also from Mauritius.

*31. **M. rosea,** *Hort. Calcutt.* Stem stoloniferous. Habit of *M. coccinea* but leaves shorter and broader. Spike short, erect; rachis pubescent not flexuose; bracts pale red. Fruit and seeds not seen. Described from two specimens in the Calcutta Herbarium that flowered in the Botanic Garden there in June 1882. It has since flowered at Kew, and a figure has been prepared for the *Botanical Magazine.*

*32. **M. sanguinea,** *Hook. f.* in *Bot. Mag.* t. 5975. Stem very slender, 4–5 feet high. Stoloniferous. Bracts bright red. Calyx bright yellow. Fruit oblong-trigonous, 2 inches long, rather pulpy, pale yellow-green variegated with red, glabrous. Seeds angled by pressure, small, black, tubercled. *Distribution:*—Upper Assam (District Lukhimpore) Mahuni forest, (Mann.) Introduced into cultivation in 1872. *M. assamica,* Hort. Bull is an allied plant, at present imperfectly known; it may prove to be distinct. Specimens of the fruits with seeds of *M. sanguinea,* ripened in the Palm House at Kew in 1872, are in the Museum.

33. **M. rubra,** *Wall.* Habit of *M. coccinea.* Bracts bright red. Fruit in 3–4 clusters of 3–4 each, cylindrical. Seeds smooth, dull brown $\frac{1}{6}$ inch diameter. *Distribution:*—Rangoon and Yomah, Pegu. Differs from *M. coccinea* by its short petal.

*34. **M. Mannii,** *Wendl.; Bot. Mag.* t. 7311. Stoloniferous. Stem cylindrical, slender, tinged with black, 2 feet high and with a girth of $3\frac{1}{2}$ inches at the base. Rachis with spike erect; bracts of female

W Fitch del et lith

Musa sanguinea, Hook. f.
(*Botanical Magazine*, t. 5975.)

1. Reduced figure of entire plant. 2. Head of flower *of the natural size*. 3. Hermaphrodite flower. 4. Perianth laid open. 5. Transverse section of ovary.

flowers deciduous; male bracts crowded, oblong, pale crimson. Fruit small 3–4 inches long, fusiform with a very broad truncate apex. *Distribution*:—Assam. Described from a plant that flowered at Kew, March 1893. [Seedlings of this crossed with *M. rosacea*, are now at Kew.]

*35. **M. aurantiaca**, *Mann. Herb.* Habit of *M. sanguinea*, but forming large clumps of rather lower stems. Bracts bright orange yellow, glabrous. Calyx yellow. Fruit green, glabrous. *Distribution*:—Forests of Upper Assam. Differs mainly from *M. sanguinea* by its orange-coloured bracts.

CULTIVATED VARIETIES.

Some of the cultivated varieties of bananas and plantains known in different parts of the world have already been mentioned in connection with the species described in the preceding section. There are, however, numerous varieties whose origin cannot, in every instance, be clearly traced. There is a good deal of confusion existing also as to what are varieties and what are mere forms. In fact, the information available in regard to cultivated bananas is in need of being thoroughly sifted and arranged. In the present state of our knowledge it is only possible to enumerate the various sorts under their vernacular names, and to add a few notes giving their special or most prominent characters. This may more conveniently be done under the principal geographical regions in which they are found. The principal authorities cited are the following:—Rumph, *Herb. Amboinense*, vol. v., pp. 125–137; Blanco, *Flor. Filip.*, pp. 239–246; Firminger's *Manual of Gardening for India*, ed. 3, pp. 179–181; Bojer's *Hortus Mauritianus*, pp. 331–332; Sagot in *Journ. Soc. Hort.* France (1887), pp. 238–285; Kurz in *Journ. Agri.-Hort. Soc.* India, n.s., vol. v., pp. 112–163; Diaz, *El Agricultor Venezolano* (1877), pp. 37–43; Harrison and Jenman, *Report on Agricultural Work*, British Guiana, 1890, pp. 56–62.

INDIA.

"In such a large empire as India one might expect," says Kurz, to find the greatest variety of bananas, but such is not the case." The Philippine Islands and the Indian Archipelago are richest, and, on the authority of Moon, Ceylon comes next. The varieties appear to decrease rapidly as we travel northward from the equator. Roxburgh states that he obtained in India only three varieties of the "plantain" and about 30 varieties of the "banana." Rheede (1678–1703) appears to be the first authority that wrote intelligently on the bananas and plantains of India. He gives them the Malabar name of *balá*. In the first volume of his *Hortus Malabaricus*, pp. 17–20, he enumerates and illustrates several varieties: *neudera balá* with oblong red fruits; *caduli-balá* with a thin skin and pulp of pleasant taste; *puambalá* with terete fruits with a good taste; *mannem-balá* with four-cornered fruits and a thick skin; *canim-balá* producing no other flowers but fertile ones, has the fruits small and yellow when ripe; *calembalá* has the fruits full of black seeds and a rather thick skin.

In **Madras** a sort known as *guindy* is considered the best as a dessert fruit. It is round, small sized, with a very thin rind, luscious, sweet, and of a most delicate flavour. "A good bunch may contain over a thousand fruits" (*Dict. Econ. Products of India*, vol. v., p. 293). This kind is used entirely as a table fruit, being considered too valuable for cooking purposes. The *rustali* is, however, the sort generally sold as table plantains, though not of so good a quality as the former. A large plantain known in Tamil as *monthen* is one of the commonest cooking fruits of the Presidency. The *poo-valay* or flower plantain of Madras is described by Kurz as "curious and rare."

In Bengal the *table plantain* is the best. This is grown entirely for the consumption of Europeans and well-to-do natives. The *champa* is the next best, and, like the preceding, is of finest quality during the rains. The term *kauch* [katch] *kolla* is employed generically to embrace all field-cultivated plantains. These are hardly ever allowed to ripen, and are mostly used when unripe as a vegetable.

The *dacca* plantain (described by Horaninow as *M. dacca*), although mentioned as one of the common Indian forms is dismissed by Kurz with the remark that, "although much cultivated in European hot-houses, it is little known out of them." The stem is pruinose; leaves paler-green than in *M. sapientum*, glaucous beneath; border of petiole red. Fruit 4 inches long by half as broad, remaining tightly on the branch; its tip and stalk bright green; skin very thick.

If identical with the *dhakkai* mentioned by Liotard, and said to have a long fruit, with light pink soft flesh, it is found in abundance in India, but only in the east of Bengal. It may also be the *daccâe* mentioned below by Firminger.

In the neighbourhood of Calcutta, Firminger (*Gardening for India*, pp. 179–181) mentions the principal varieties of plantains cultivated there as follows:—

Champa. Decidedly the finest of all the plantains, rivalling in lusciousness and delicacy the most delicious pear. The plant has a tinge of red on the stem, and the central rib of the leaf, both on the upper and lower side, is also red. The fruit is about 6 inches long, of a pale straw colour, and not fit to eat until it can be removed easily from the bunch.

Cheenee champa. Similar to above, but the fruit much smaller, not much larger than a man's thumb. It is borne in large, densely compact bunches.

Martaban. A delicious fruit resembling the *champa*, and by some considered equal to it. The plant has no red midrib, but the rim near the base has a slight border of reddish brown.

Daccâe or *daccâe-martaban.* Has a flavour surprisingly rich and luscious. The plant is recognised by "the large quantity of lime-like powder coating the stem and under-side of the leaves. The fruit is 4 inches long, with a very thick rind." [A specimen of the fresh fruit of *M. dakka* is in the Kew Museum from Mr. H. H. Calvert, grown at Alexandria, Egypt. It is very angular, and in section the placentas are strongly marked.]

Kuntéla. An inferior fruit, though the one cultivated most extensively of all, and sold in great quantities in the bazaars. "The cause of the very great demand there exists for this particular kind among the natives is on account of its being employed in offerings to Seeva, it being the only sort, too, they think right to use for that purpose." The plant has the leaves and footstalks of a pure rich green. It grows to a great height.

Kutch kela. Fruit of large size, used only in its unripe state for curries. "When boiled it has somewhat the flavour of the parsnip, and is a nice vegetable with roast meat." [The model of a large fruit in the Kew Museum, labelled *Musa kela*, probably represents this variety.]

Mâhl-bhôg or *mohun-bhôg*. Highly esteemed by some, but probably not much superior to the *kuntéla*.

Râm kela. In good condition a remarkably fine fruit, much resembling in flavour and buttery consistency the *daccâe*. The stem and footstalks and midribs of a dark red colour. Also the flowers. The fruit is about 7 inches long and rather thin. This Firminger names Musa rubra, now reduced as a variety of *M. sapientum*. On the other hand *M. rubra* of Wallich is a seed-bearing species allied to *M. coccinea*.

Dwarf or *Chinese* Plantain [*M. Cavendishii*]. In Calcutta this is exceedingly difficult to obtain in perfection, as it is uneatable till quite ripe, and on its becoming ripe commences almost immediately to decay.

Arracan plantain. Sent from Arracan by Captain Ripley, who observed, "If well manured the fruit of this tree is one of the best plantains there is; the old trees yield particularly fine fruit." Besides the above, Captain Ripley sent to Calcutta eighteen other named sorts of plantains from Arracan, of eleven of which he wrote in high commendation. The *moungbya* has the skin "of a dead white and very thick."

Captain Ripley was acquainted with 19 kinds, described by him from Arracan in the *Proceedings of the Agri.-Hort. Soc. India*, x., pp. 50, 51.

The *hnet-pyau-meng* (royal plantain) has fruits up to 15 inches in length and as large round as the fist. It is generally eaten roasted whole in the skin. *Rakoing-hnet-pyau-bhee* or Arracan plantain (*Musa arakanensis*, Ripley) mentioned above is also valuable for its fibre. Nothing further is known of this plant. Specimens of it are desirable for herbarium purposes.

In the Punjab the *kela*, which may be a true plantain (*M. paradisiaca*), is largely grown towards the east of the plains of this province. There are fewer varieties and the quality of the fruit is poorer in the Punjab than to the east and south. At Mussooree, in the North Western Provinces, there are only three kinds of bananas cultivated. These are *rai kela*, *bara kela*, and *chota kela*. In Oudh the only plantain that flourishes is a large-fruited one called *desee kela*. A small sweet fruit called *jmritban*, probably a local corruption of Martaban, and the *cheenee champa* or red Bombay, are also grown, but neither thrives well.

CEYLON.

Moon, in his catalogue of Ceylon plants, gives only the Singhalese names and their English equivalents. His list of bananas (pp. 71–72) comprises as many as 47 kinds, thus rendering Ceylon richest in varieties, the Indian Archipelago alone excepted.

Of *Musa paradisiaca* ("anawâlu-kesel" of the Singhalese) Moon enumerates the following:—Wild, growing on the mountains: *anawâlu-kesel aetamburu* (seed), and *anawâlu-kesel-gal* (rock). Cultivated: are names with the following English equivalents: sour, sooty, parrot, black, buffalo, champac, lion, and monkey.

Of *Musa sapientum* ("kesel" of the Singhalese) there are wild, growing on the mountains: *kesel ael* (hill), *kesel aeta* (seed), *kesel titta-kadali* (bitter), *kesel wal-suwanda* (wild-fragrant), and *kesel wal-wanduru* (wild-monkeys). Of the cultivated sorts belonging to this series Moon gives 25 under their Singhalese names and their equivalents. Amongst the latter are such names as water (*kesel diya*), black (*kesel kalu*), and others known as eared, fragrant, cornered, scented, golden, cracker, pingo, clustered, bitter, fool's, powdered, &c.

Musa Troglodytarum of Moon ("nawari kesel" of the Singhalese) is said to be wild in the mountains of Kandy, although not mentioned by subsequent writers. Of this there are said to be three cultivated sorts, *nawari-kesel sudu* (white), *nawari-kesel kalu* (black), and *nawari-kesel tis* (thirty). The wild plant is *nawari-kesel aeta.*

Thwaites mentions only one wild species in Ceylon, his "wal-kaikel gas" (*Musa sapientum*), and he adds this is the species from which have originated the numerous varieties of sweet plantains in the island. Kurz remarks: "There seems to be something wrong in this statement, considering that Moon has eight wild kinds, of which one (his *M. Troglodytarum*) should have an erect spadix."

Sawers (*Mem. Wern. Soc.*, iv., 403), refers to the wild species of plantain found in the mountains of Ceylon as follows:—"It was on the sides of these rugged hills that we first saw the plantain-tree in a state of nature. When uncultivated the fruit of this plant is comparatively small. It contains a great many seeds and has but little pulpy matter."

INDIAN ARCHIPELAGO.

The **Philippines** and the **Indian Archipelago** are regarded as the richest regions in bananas. Blanco's researches were chiefly confined to those of the Philippine islands. He divides them into two classes, the first containing thick-skinned bananas and the second thin-skinned bananas. He mentions that there were 57 varieties known in the islands, and he enumerates and names 18 of them. The most esteemed sort is *saba-bisco,* with a fruit 3 inches long by 1 thick, 3–5 angular. The *lacatan* has the fruits crowned with the persistent corolla. One of the most esteemed is a large one with a sweet pulp, called the *bungulan.* One variety, called by Blanco *Musa paradisiaca ulnaris*, is thus described:—"Those that have seen and eaten the fruit say it is as thick as the human thigh and a yard long and bears seeds. If cooked it resembles in taste that of the *tandok.* The Negritoes say the raceme produces but one fruit." Blanco is careful to add that he himself does not believe in the existence of such a fruit.

In Lucon, Née observed 27 varieties of bananas, but he has not given their names nor any remarks upon them.

Rumph appears to have known more about bananas than any one. He has given an accurate description of the plants, and he divided them into three groups, as follows:—(1) The cultivated or domesticated bananas; (2) the Alphurian bananas, with leaves on the rachis; and (3) the wild bananas. His detailed descriptions of the varieties are very carefully drawn up. Some of the kinds enumerated by him are as follows:—

Pisang tando (horn-like). No doubt similar to the one called tanduk or tandok at the present time. If the cluster is reduced to a single fruit, the latter becomes exceptionally large. The whole bunch or spadix has usually only two or three clusters. *Pisang gabba-gabba* is smaller than the preceding, becoming white in ripening. It has the driest pith of all, which is like the spongy pith of the Sago palm, called "gabba-gabba."

Pisang djernang (needle banana). The fruit is short, nearly trigonous and terminating in a long snout, which is crowned with a thread-like appendage (the marcescent style), hence the name. The skin adheres to the reddish pulp, which glitters like sugar when transversely broken. It is said "to bear racemes 7 feet long with 17 clusters."

Pisang culit tabal (golden banana). The fruit is five-cornered, and has the thickest skin of all the bananas.

Pisang medji. The dessert-banana (*M. mensaria* of Rumph), is "the best of all bananas." The fruit is about 4–6 inches long; it ripens quickly, is yellowish, and the skin is easily removed. The pulp is soft, sweet, and deliciously scented, as if with rose-water. Always eaten raw.

Pisang raja (to which Rumph gave the name of *M. regia*), is similar to the preceding in shape and quality. It is, however, much smaller, hardly the length of a finger and an inch thick, smooth with a thinner skin, and sweeter and more delicious, on which account it is the most prized as a dessert fruit in Batavia. It is not cultivated at Amboyna, where it is replaced by the preceding kind. Probably nearly allied to the *gingeli* of Bourbon.

Pisang swangi is short and thick. The pulp deep yellow or red. Cannot be eaten raw, but is good for roasting.

Pisang abu, *pisang soldado*, and *pisang alphuru* are small, short and thick fruited sorts, rather flat and compressed. Very good for roasting and cooking.

Pisang bombor has the shortest fruits, the size of a hen's egg. Good for eating raw when fully ripe; otherwise it is sourish and acid, and must be boiled.

Pisang cananya ketjil. This has the shortest stem and the smallest leaves, and is only about as high as a man. The fruits are round, the skin very thin, fragile, and can hardly be removed. The fruits grow so low that "they can be taken off with the mouth," and they are often 200 on a bunch. The plant is only sparingly soboliferous.

Pisang tonkat langit has an upright fruited spadix (*Musa Troglodytarum*, Lin.). The fruits are small, plump, more thickened towards the upper end, of a red colour and black striped. The pulp is golden yellow. The few seeds are imbedded lengthwise, brown and flat. The "djantong," or sterile flower cone, is much larger than in any other bananas, sometimes a foot long, green and smooth.

Pisang alphuru. The peduncle is peculiar in bearing leaves, "two of which are at the base and similar to those of the stem, but shorter and rounder. Then follow other leaves which are small and narrow, and from each of them rises a thick green stalk on which grow a few fruits, of which, however, only a few come to perfection." As in other respects this resembles the common banana, it may be an abnormal form of it.

Pisang utan (Musa sylvestris of Colla), is the larger kind of wild banana. One form (the Mindanao of Rumph) is *Musa textilis*, Née, yielding Manila hemp. The other (Ambon variety of Rumph) is *M. textilis*, var. *amboinensis*. These have been already described in the previous section.

From other sources we gather that bananas in Java are called *pisang maas*, or golden pisang, on account of the colour of the peel. There are so many varieties that they can scarcely be counted. The *pisang sariboe* is the smallest kind of pisang, as the *pisang tandok* is the largest. The *pisang maas* is quinquangular, and its taste resemble, that of figs. Among the other sorts the most remarkable are *pisang medji* (dessert pisang), the *pisang raja* (royal), which is thought to be the most wholesome; the *pisang mera*, or red pisang, whose leaves from their very base are of a brownish-red as well as their bunches of fruit, and the *pisang batoe* or *bidgi* (stone or seed pisang), which is not much eaten. There is yet another kind of Musa, the wild pisang, "whose leaves on the outside are covered with a species of white wax" (*van Nooten's Java*, 1863).

Rigg, in his dictionary of the Sunda language, gives a list of about 40 names of plantains in **Western Java**. The word *djauw* is the Sunda for pisang or plantain. The most singular is the *lubang*, or eel plantain, described by Kurz as "a very rare variety; the fruit is said to ripen in the stem before it is protruded hence, likened to an eel in a hole." In the *sambatu* the fruits grow together, as if glued into one mass. Marsden, in his history of **Sumatra**, mentions that there are 20 varieties cultivated in that island, of which *pisang raja*, *pisang dinger*, and *pisang kalé* are the best.

Of the bananas of **Siam** little is recorded. The fruit is there called *tun-bloi* or *kloh-eh*. Mason collected the names of 25 varieties in **Burma**.

Specimens of fresh fruits of *pisang maas*, of *pisang susu*, and of *pisang tandok*, preserved in spirit, are in the Kew Museum, from Mr. H. N. Ridley, F.L.S., Singapore, 1894.

Burbidge, in the *Gardens of the Sun*, pp. 321–2, reviews the different varieties of plantains and bananas that came under his observation in the East, as follows :—

"Last on my list, but by no means least amongst the tropical fruits of Eastern gardens, comes the *pisang*, or banana, which here, as elsewhere wherever it is cultivated, is represented by many varieties, which differ in size of fruit, flavour, and other particulars. One of the most common varieties met with in the bazaars is *pisang maas*, or golden banana, the individual fruits of which are small, but of a bright golden colour and of excellent flavour. One of the most esteemed of all is *pisang raja*, or king of bananas, a larger fruit, also of a deep golden colour, the flavour being very luscious. *Pisang hijau*, the green banana, is slender and angular, but the straw-coloured pulp is of a most exquisite flavour, and it is quite a favourite in Singapore, where the *raja* variety is comparatively scarce. *Pisang kling* is a pale yellow kind, bearing large smooth fruits, and for eating with cheese this is one of the best, being less sweet than those just named. A large horned variety of banana (generally used in a cooked state) is common in Borneo, called of the natives *pisang tandok*, the individual fruits being a foot long and two inches in diameter. The outer skin is green, changing to yellow when fully ripe, and this fruit is liked by those who do not relish the sweeter kinds."

POLYNESIA.

There are numerous wild and seed-bearing bananas in the islands of **Polynesia** probably undescribed. Specimens of these, but not sufficient for determination, have been received at Kew from the Solomon Islands, from Mr. H. B. Guppy, and from Timor Laut from Mr. H. O. Forbes.

Ellis mentions that in the Society Islands nearly 20 kinds of plantains (probably forms of *M. Fehi*), very large and serviceable, grow wild in the mountains. "These are rich and agreeable when baked, but most unpalatable when raw. They have a red skin and a bright yellow pulp. Their native name is *fei*." The best banana in Tahiti is called *huamene*.

TROPICAL AFRICA.

The different varieties of bananas and plantains cultivated in tropical **Africa** have not been investigated. The native names quoted appear to stand simply for banana or plantain, and, except in one or two instances, do not apply to the varieties. At Angola, Welwitsch met with a very ornamental variety of *M. sapientum*, which he named *M. sang inea.* In this the "leaves and fruit are strongly tinged with blood-red." Another ornamental plant, also belonging to *M. sapientum*, and from West Africa, is *M. vittata* figured in *Bot. Mag* t. 5402. This has the leaves and long fruits copiously striped with white. The bracts are bright red inside." It was imported into this country in the first instance from the Portuguese island of São Thomé, in the Gulf of Guinea.

Burton (*Central Africa*, p. 58) states that in the hilly countries around Uganda there are about a dozen varieties. . . . The best fruit is that grown by the Arabs at Unyanyembe. . . . Upon the Tanganyika Lake there is a variety called *mikous t'hembu*, or elephant's-hands, which is considered larger than the Indian horse-plantain. The skin is of a brickdust-red, in places inclining to rusty-brown; the pulp is dull yellow with black seeds, and the flavour is harsh, strong, and drug-like.

Stanley (*Darkest Africa*, I. p. 252) refers to specimens of plantains found beyond Yambuya that were "22 inches long, 2½ inches in diameter, and nearly 8 inches round, large enough to furnish even Saat Tato, the hunter, with his long-desired full meal." Again, at Bokokoro, "some plantains measured here were 17½ inches in length, and as thick as the forearm."

MAURITIUS and MADAGASCAR.

Bojer (*Hort. Maur.*, p. 331) mentions that in 1837 bananas and plantains were widely cultivated in Mauritius, Madagascar, Mozambique, and the Comoro Islands.

He enumerates 17 species and varieties cultivated at Mauritius, and gives both the Creole and Malagasy names as far as he knew them.

There are two species specially mentioned producing seeds, and these he calls *bananier á graines*: (1) *Musa sapientum*, L. of the East Indies, grown near dwellings in various quarters of the island. It thrives also without cultivation on the sites of abandoned gardens and other localities in the hilly district of Flacq and the mountains of la Nouvelle Découverte; and (2) *Musa glauca*, Roxb., grown under cultivation in many parts of the island, but said to flower very rarely. It is probable that the first of these is the true banana with seeds (*bananier á graines*), and therefore to be regarded as representing the wild form of *M. sapientum*. In a note just received from Mr. John Horne, F.L.S., late Director of Gardens and Forests at Mauritius, he writes:—"I know the *bananier á graines*, and I have raised it from seed. Every clump of this (wild in the mountains) is known to the Coolies and Creoles who readily eat the fruit, which must therefore be watched to obtain it in a perfectly ripe condition. The stems of this banana abound in fibre of excellent quality."

The fruits of *Musa paradisiaca* (of Bojer) are called Akundru lika-lika by the natives of Madagascar, while the French call them *bananes malgaches.* Bojer enumerates the following kinds:—

Akundru bara-baha of the Malgachees (*bananes malgaches vertes*): fruits resembling those of akundru lika-lika, but they are shorter and more curved. Skin green, the pulp white, soft, and sweet.

Akundru minetine; fruit straight, cylindrical, green turning brown; pulp whitish, very sweet. A variety of this has the fruits very like those of the preceding, but they are only slightly curved, angular, the pulp whitish, of an exquisite taste and odour.

Akundru-makaï-fahaï (*bananes jaunes* or *bananes à régime court*): fruit medium size, straight, cylindrical, the skin and the pulp yellow, the latter firm and sweet.

Akundru-bara-hassok (*bananes malartic* or *bananes rouges*): fruit straight, cylindrical, sometimes slightly cornered, the skin thin and of a red colour when ripe, the pulp yellow-reddish, of a very sweet taste and odour.

Bananes malartic vertes of the French. Fruits exactly like those of the preceding, but they remain green also when fully ripe.

Bananes gigantesques de Chine. Fruit very large, oblong, slightly curved and angular, the skin yellow and very thick, the pulp yellow-reddish, somewhat firm, of a little acid taste.

Akundru-lambu of the Malgachees (*bananes de Chine* or *bananier nain*): stem very short and very stout, the leaves oval, larger and firmer than those of the other kinds. The raceme often attains such an enormous size that one man cannot carry it. Fruits yellow or green, slightly curved and cornered; pulp yellowish, of an exquisite taste and odour.

Akundru-zaza (child's banana) of the Malgachees (*bananes gingeli* of the French): fruit very small, straight, cylindrical, the skin thin, yellow; pulp yellow, very sweet and of an agreeable odour. This kind is most esteemed.

Bananas d' Otahiti: fruit somewhat larger than that of the preceding, somewhat curved and angular, the skin yellow or green and very thick; pulp yellowish and of an agreeable taste.

Akundru-foutsi of the Malgachees (*bananes blanches*): fruits middling sized, straight, cylindrical, the skin and pulp white, the latter of a mediocre taste.

The banana mentioned above as the Chinese or dwarf banana (*M. Cavendishii*) is a distinct species. This was introduced to England by way of Mauritius in 1827, and first grown in this country by Mr. Barclay at Burryhill. It was afterwards distributed from England, as already mentioned, to the Islands of Polynesia.

There is a sample of fibre in the Kew Museum from the Botanic Garden, Mauritius, sent by Mr. John Horne, F.L.S., 1870, marked *M. violacea.* This is probably a garden variety of *M. acuminata* (*see* p. 245), with the stem, fruit, and often the leaves beneath, more or less tinged with violet or purple.

Although it is pretty well established that the New World received its plantains and bananas originally from the Old World it is evident that there are now numerous varieties established there. Some of these can be recognised as similar, if not identical, with well-known varieties in the East Indies. On the other hand, some have doubtless developed under new conditions of soil and climate and under the incidental variation induced by change of environment and results of cultivation. The local names are very loosely applied. The Spanish names for the most part are limited to three kinds. The true *platano arton* is the plantain used as vegetable, while the *camburi* and *dominico* are varieties of the banana with a sweet fruit, and eaten raw. The dwarf or Chinese banana (*M. Cavendishii*) has become very common of late years. This was doubtless introduced direct from Mauritius (where we have a first record of it after Cochin China) or by way of England. With the exception of the latter it is probable that the edible-fruited banana and plantains of the New World are all forms of *M. sapientum.* The herbarium material available at Kew does not contradict this assumption, but it must be admitted that no one has given particular attention to the subject or collected adequate material upon which to base an authoritative opinion.

Martinet enumerates the three bananas cultivated in **Peru**, in the neighbourhood of Lima (*Jard. Bot. Lima*, 1873, p. 51), as follows :—*platano guineo*, *platano lugo*, and *platano de la isla*.

Humboldt states that a Peruvian banana called *meija* is known in the market of Lima as *platano de Taiti*, being supposed to be introduced from Tahiti.

BRITISH GUIANA.

Messrs. Harrison and Jenman, in their Report already cited, state :—

There are two varieties of plantains chiefly cultivated in **British Guiana**, namely, the White plantain (called also the Cow plantain, Common plantain, or Maiden plantain), and the Black plantain. The others are the Giant or Horse plantain and the *barooma*. Both of the latter are very large fruited kinds. The *barooma* is not much grown.

The White plantain with a green stem and green leaf-stalks is the kind chiefly grown. It is prolific and very valuable, as the fruit is of the best quality and adapted for all purposes for which plantains are used. The Black plantain is exactly similar to the White plantain in character, but the leaf-stalks and sheaths of the leaves (*i.e.*, the stem) are purple or blackish.

For the banana the local name is *bacooba*, a term of Indian origin (evidently borrowed from its resemblance to the *Heliconia*, a native plant common in tropical America), but now generally adopted by the Creoles. Bananas are not largely grown in British Guiana, the quantity produced is, however, fully sufficient to meet local demands. There is no separate cultivation as for plantains, and they appear to hold quite a secondary place in the domestic regime of the colony. Plantains are regarded as an essential article of food, while the bananas are an added luxury, and they can be dispensed with or not according to the circumstances of the moment.

The most abundant banana in the market at Georgetown, as a rule, is the dwarf or Chinese banana, and next to that the large and small fig banana. The latter are favourites with the well-to-do people. The varieties grown in the colony are as follows :—

Small Fig or *Lady's finger:* fruit densely packed, clear straw colour when ripe, 3 to 4 inches long, pulp melting, flavour good.

Large Fig or *cokerite:* fruit curved as a rule, 4 to 5 inches long ; good bunches contain 300 to 400 fruits ; strongly recommended for export purposes.

Martinique or *Jamaica:* fruit greenish yellow, 8 to 10 inches long, of sweet flavour with a slightly astringent after-taste.

Surinam or *sour:* fruit slightly curved, 6 to 8 inches long, clear straw colour when ripe, texture of pulp rather woolly when broken, the centre harder, of a distinct sub-acid taste.

Giant green or *Canaan:* fruit stout, densely arranged, 6 to 7 inches long, colour a beautiful yellow when ripe.

Giant red: fruit stout, dull red, 5 to 7 inches long, flavour good. Both this and the last are too stout for ordinary dessert purposes.

Arrababa or *apple:* fruit of soft texture and slightly sub-acid, 7 to 8 inches long, skin very thick, pale yellow when ripe. "A peculiar kind in all characters of the fruit; the shape, thickness of the skin, texture, and taste are all unusual. It is not of much use for eating raw like other bananas, but cooked it is the best of all."

Chinese or *dwarf:* fruit curved, 7 to 9 inches long, greenish yellow; produces the heaviest bunches of all, often exceeding 80 pounds and containing 200 fruits. "Sometimes the bunches appear nearly as long as the stem of the plant bearing them."

VENEZUELA.

An account of the principal varieties of banana recognised in Venezuela is given by Diaz in *El Agricultor Venezolano* (1877), pp. 37–43.

El platano or *platano arton* is the common plantain widely distributed throughout tropical America.

Platano dominico, the royal or small-fruited plantain, is very similar to the common plantain in appearance and habit; the fruit, however, is smaller and the plant somewhat hardier, that is, it bears better the cold of the mountains.

Platano topocho or the topocho plantain. Diaz regards this, to which he has given the name of *Musa mixta*, as a hybrid between the common plantain and the red banana. It approaches the former in the character and flavour of the fruit; the latter in its robustness, habit, and power of resistance to dry weather. On account of the latter quality the *topocho* and red banana are preferred as shade plants on coffee lands on the hills. The fruit of the *topocho* when ripe is readily eaten by man and animals. "It is a special favourite of hens, ducks, turkeys, and all the feathered family."

Cambur morado, or the red banana, differs from the preceding in the colour of the stem and fruit. The fruit of this red banana is specially suitable for preserving by being dried in the sun.

Cambur criollo or the Creole banana. The plant is smaller than either of the above, the stem is stained with blotches and black streaks, the fruit is small and very palatable to eat with dessert. In a green state it is most suitable as an addition to the Spanish *olla* or stew.

Cambur manzano or the apple banana. The stem and leaves are tinged with red; the fruit is as small as the Creole banana. It has a very delicate flavour and it is the most highly esteemed of any.

Cambur pigmeo or dwarf banana. This hardly attains a height of 5 feet (probably the Chinese banana, *M. Cavendishii*). The bunch of fruits is so large that it sometimes touches the ground. The fruit is slightly larger than the Creole banana, but with a similar flavour.

Fresh fruits preserved in spirit of two kinds of plantains and bananas from Venezuela are in the Kew Museum. These were originally sent to the International Exhibition of 1865, and presented by the Republic of Venezuela. The first is marked *platano dominico*, "bannanier royal" or Royal plantain; the fruit is about 8 to 10 inches long, 2 inches diameter, rather prominently ribbed, almost quadrangular, much curved, with the point produced but blunt. The other is named *camburi guineo*, "figues bananes de Guinie" or fig banana. The fruit is 6 to eight inches long, 1½ inches diameter, slightly angular and almost terete, moderately curved, rounded at the top and crowned by the withered parts of the flowers. This appears to approach very closely the Martinique or Jamaica banana in size and colour.

West Indies.

The varieties cultivated in the West Indies for export purposes are thus described by Dr. Nicholls, F.L.S., in *Tropical Agriculture*, p. 160.

"There are a great number of varieties of the banana, as might be expected when it is remembered that the plant is cultivated throughout the whole tropical world—on different soils, in different climates, and under different conditions. The kinds most liked, however, in the American markets are the Martinique variety, with its large yellow fruits, and the Cuban variety which has shorter and thicker fruits with a dull-red skin. The Martinique kind is now the principal one exported, and it is known throughout the United States as the 'Jamaica banana.' In Dominica it is called 'figue la rose,' and in Trinidad 'Gros Michel' banana."

Of plantains, as distinct from bananas, there appear to be in the West Indies two principal sorts, the "horse plantain" and the "maiden plantain." The distinction between the two is given below.

Acosta, quoted by De Candolle (*Cult. Plants*, p. 309), says that in Hispaniola or **San Domingo** "there is a small white species of banana, very delicate, which is called in Espagnolle 'dominico.'"

The cooking plantains cultivated in **Jamaica** are described by Lunan, p. 74, as follows:—

"There is a variety known by the name of *maiden* plantain, the common kind being called *horse* plantain, which differs from it in being of a smaller and more delicate growth, and having red streaks on the stem; as also in smaller but much more clustered and numerous fruit; the maiden plantain bunch growing more like that of the banana, containing often from 80 to 100 plantains, and weighing often 80 pounds, whereas the bunch of the common plantain seldom contains more than 20. These trees bear fruit fit for use in from 9 to 12 months after the suckers are planted, according to soil and seasons; the horse plantain takes three months to fill from the time it first shoots, and the maiden plantain four; the latter is the most delicate food."

Dr. de Verteuil describes the plantains of **Trinidad** briefly thus:—

"Like all cultivated plants, the plantain has many varieties: there exist, however, three distinct sorts. The *horn* plantain, from the resemblance the fruit bears to the horn of a young bull; the *French* plantain and the *Dominica* plantain. The *horn* plantain is more extensively cultivated than the other sorts, being hardier and not requiring frequent replanting; but though the fruit is much larger, whence it also obtains the *sobriquet* of *horse* plantain, its bunch is not so well supplied, having ordinarily but 25, and often fewer, plantains or fingers to the bunch; as an edible it is also much coarser than the other species. *French* or *maid* plantain: the body of this plant is of a dark violet colour, as also the nerves of the leaves; the fruit is smaller than that of the former, but the bunch is supplied with a much greater number of plantain-fingers, averaging about 60 and 80, but sometimes from 100 to 130. This species is regarded as more delicate than the others, particularly when ripe. *Dominica* plantain: this is a variety of the latter; though the body is exactly like that of the *horn* plantain, the bunch, however, resembles that of the *French*, but the fruit is somewhat shorter and plumper."

CULTIVATION.

The fruit-bearing Musas, require a moist and uniform heat. They do not necessarily require an abundance of light, as many will grow in the shade of trees. They require, however, a deep rich soil and newly cleared forest land, containing plenty of vegetable mould. Outside the torrid zone the plants are chiefly ornamental, as they cannot be depended upon to produce fruit in anything like the profusion they do in the tropics. In cool countries also bananas do not grow continuously as in the tropics, but they have a resting period during the winter when the leaves cease to develop, or even partially wither. They break forth, however, on the return of warm weather. In such a case the life of the plant extends over a longer period, and stems, which usually last only a year, may live for two or three, or until fruit is produced. In many countries, even in the tropics, where the plants are liable to injury from hurricanes, their cultivation is either wholly abandoned, or only dwarf sorts are grown, like the Chinese bananas, under shelter of houses or walls. In spite of the usually luxuriant growth of bananas and plantains, they yield very poor crops in land that has long been under cultivation, and where the humus is exhausted, even though the soil remains productive for other plants, such as sugar-cane, cassava, maize, millet, and sorghum. In very sandy soils the banana may flower, but it produces no fruit. Abundant, but not stagnant, moisture in the soil is necessary, and the finest plants are generally seen on the banks, and in the neighbourhood of streams. Kurz states that "transplantation of the shoots improves the quality of the fruit." This may mean either that the shoots should be severed from the parent stem and planted singly, or that it is an advantage to exchange shoots from one district to another. It has been proved in the West Indies that bananas grow most luxuriantly in warm, moist valleys, shut in amongst the mountains. There they succeed better even than in the open plains, probably on account of the shelter they obtain and the moister climate. They grow on mountain slopes up to elevations of 3,000 to 4,000 feet, but they begin to lose some of their vigour long before they reach the latter elevation. The growth is slower, and the bunches are not so large nor so abundant. A mean annual temperature of 75° to 80° Fahr. appears to suit them best; although Dr. Ernst states that he has seen a plant of *Musa sapientum* laden with full, ripe fruit, near Caracas, at a height of 5,175 feet, with a mean annual temperature of 66·2° Fahr. Lieutenant Parish found two or three banana plants cultivated in an enclosure at an elevation of 5,400 feet on the Chumba range in the Himalayas. Considering the latitude this is probably the highest limit of cultivation in Northern India. Further south, in the Nilgiris, Kurz says a small wild banana grows on grassy plateaux at an elevation of 7,000 feet. There are seeds in the Kew Museum of a wild *Musa* from the elevated plateau of the Wynaad which may be allied to this.

Firminger records that plantains were growing at Firozpur in 31° N. lat., "but there is little probability of obtaining good fruit from them so far north, as the frost cuts down the plants in the cold season, and they only recover themselves, so as to begin to bear fruit, when the cold season comes round again, and they are unable to mature it."

At the same latitude, however, in the insular climate of Bermuda, in the North Atlantic, Jones mentions both the plantain and banana amongst the cultivated fruits of the islands. He adds, "there is also a dwarf variety," possibly the Chinese banana (*Musa Cavendishii*).

In Borneo, Burbidge says:—

"That most generous of all food-giving plants, the banana, is everywhere naturalised in Borneo up to an altitude of 3,000 ft. It fruits all the year. . . ."

Seemann, in the *Botany of the Herald*, p. 336, speaks of *M. sapientum* as succeeding well in the lower coast of north-west Mexico, "but it never bears fruit at Durango, 24° N. lat., where it is cultivated only for its ornamental foliage."

It is recognised everywhere that the dwarf banana (*M. Cavendishii*) does not require so much heat as varieties of *M. sapientum*, and on this account it is usually selected for cultivation in sub-tropical countries.

"This sort," remarks Sagot, "I have seen in the Canaries, cultivated in abundance, with the help of irrigation. It grows well, and gives an abundance of fine spikes. The growth is suspended from November to April; its leaves, however, remain green and fresh, and unless the wind, too much laden with saline spray from the sea, blackens them." In Algiers the banana is merely cultivated as a curiosity in some of the gardens near the coast. *Musa Ensete*, however, grows well there, and fruits freely. In Lower Egypt, according to Bromfield, the banana succeeds well, but it is principally confined to the gardens of the wealthy.

In what are known as the Gulf or the Southern United States of America, just outside the tropics, the banana is often grown, although fruit is not expected more than once in four or five years. It is met with in the open air (in sheltered gardens) from Southern Texas to South Carolina. In Florida its culture for profit is not carried on farther north than Putnam County, and even in parts of South Florida there are few large patches, though nearly everyone has a few plants. The fruit is generally inferior in quality compared with tropical fruit. Often, as in the severe frost of 1886, all the banana plants in Florida are killed to the ground. In the exceptionally mild climate of California in N. lat. 34° (corresponding to that of Cyprus), bananas have ripened in the open air, as, for instance, at Tustin in Los Angeles County. The principal Musad grown in California is the ornamental Abyssinian banana (*Musa Ensete*). This has produced seed from which plants are now growing in many parts of the State. The Abyssinian banana also flowered and fruited at Palermo in South Europe in 1873. The flower spike was over 5½ feet long. The seeds ripened and produced plants. A plant at Parc Monceaux near Paris also flowered in the open air, but did not produce fertile seed.

As to Australasia, in New Zealand, Tasmania, Victoria, the southern parts of South Australia and Western Australia, the climate is too cold for growing bananas for fruit purposes. In the more tropical parts of New South Wales, in S. lat. 28° to 30°, the banana is said to "grow well and produce excellent fruit, some localities being better suited than others . . . . but notwithstanding the ease with which the plant can be grown very few settlers seem to grow it." In Queensland, and especially the northern parts within the tropics (as also in corresponding parts of South and Western Australia), the banana flourishes with great luxuriance.

The cultivation of "plantains" in **India** is thus discussed by Firminger (*Gardening for India*, p. 178):—

"The plantain delights in a very rich soil. Plants should be put out 6 or 8 feet apart in a trench, about a foot or more deep and 3 feet wide, which should be well supplied from time to time with fresh cow-dung, and abundantly watered. There should not be allowed to remain more than three stems to each plant, and the suckers, which will be constantly springing up, should be removed as soon as they make their appearance. The stem that has once borne fruit should be cut down close to the ground, as it will never bear a second time, and a fresh sucker should be allowed to grow up to replace it. The plantain, however, as it appears to me, soon wears out the soil in which it grows, and is immensely benefited, I consider, by removal about every two or three years into entirely new ground."

In **Ceylon** the cultivation of bananas is almost entirely in the hands of natives who grow them around their dwellings for shade as well as for the fruit. The *Ceylon Directory* states that while the mango, jambu, and several other fruits are particularised in the *Mahávansa* (a metrical chronicle in Pali of Ceylon from B.C. 543 to A.D. 1750) no mention is made of the plantain. The area under cultivation now in the island is said to be not less than 24,000 acres. "It affords to some extent here, as in almost every other country in which it is grown, an excuse for idleness. Dilke calls it 'the devil's agent' so little labour is required for the rich return in fruit." In the absence of a market abroad for the fresh fruit, only enough is grown to supply local wants.

In 1892 the "Jamaica banana" (known also in the West Indies as the Martinique banana, in Dominica as the *figue la rose*, and in Trinidad as the *Gros Michel* banana) was successfully introduced through the aid of Kew from Jamaica to **British New Guinea.** Sir William MacGregor, K.C.M.G., in acknowledging the safe arrival of the shoots and suckers, mentioned that in September 1892 they were growing at the Government Station in the Mekes district. He adds, "I have hopes that in the future they may become a valuable export from this place."

A great many different kinds of Musas are cultivated in the Islands of **Polynesia.** They may be arranged in two natural groups under the native names "fei" (*Musa Fehi*, Vieill.) and "maya" (*Musa sapientum*).

The dwarf or Chinese banana, known in Fiji as "Vudi ni papalagi" (*i.e.*, foreign banana), though introduced, as already mentioned, within the last 50 years is now widely cultivated everywhere.

In 1889 the Governor of **Fiji** reported that "the quantity of bananas exported from the islands is now considerably over half a million bunches per annum, and in the Colony the trade may be said to have been thoroughly established."

As described by Mr. John Horne, F.L.S., in *A Year in Fiji*, p. 81 :—

"Banana plantations abound everywhere, and extensively so in Colo, in the mountain districts of Viti Levu. They are planted along the sides of the road to shade the traveller from the sun, sometimes forming avenues miles in length or more. The fruit on these trees is *tabu*, that is forbidden to travellers. The *tabu* is invariably respected by the natives.

"Bananas are planted in rows, 8 feet apart, and the same distance is allowed between each tree. Suckers from the sides of old roots are used as plants, the leaves being cut off before planting. The soil in the place where the young tree is to be planted is dug in a circle of about 3 feet in diameter, and to the depth of 2 feet, and well manipulated."

The Report of the Agricultural and Industrial Association of Fiji for the year 1889 shows that the export value of bananas for the previous year was about 12,000*l.* and there is no reason why it should not be more than doubled. Care and attention have been latterly bestowed upon the cultivation and selection of the fruit, and when this has been done the banana disease (*Kew Bulletin*, 1890, p. 272, and 1892, p. 48) has not made much headway.

In the year 1891 two Wardian cases of the Jamaica banana, the fruit of which is so largely exported to the United States, were received at Kew from the Botanical Department, Jamaica. These were forwarded at the request of the Governor, Sir John Thurston, K.C.M.G., who was desirous of adding this sort to those already under cultivation in the Colony. After being cared for and repacked at Kew, they were sent to the Botanic Station at Suva by way of Sydney. Many of the plants survived the long voyages to Fiji, and in May 1892 they were reported as "growing apace."

Burton (*Cent. Africa*, ii., p. 58) says :—

"The Mdizi or plantain-tree is apparently an aborigine of these latitudes; in certain parts, as in Usumbara, Karagwah, and Uganda, it is the staff of life. A single bunch forms a load for a man. It is found in the island and on the coast of Zanzibar, at K'hutu in the head of the alluvial valley, and, though rarely, in the mountains of Usagara. The best fruit is that grown by the Arabs at Unyanyembe; it is still a poor specimen, coarse and insipid, stringy and full of seeds, and strangers rarely indulge in it."

Speke says the plantain or "N'deezee" is the food of the countries one degree on either side of the equator, acres of ground being covered with its groves. On the high lands of the interior it ceases to grow at 2° N. lat.

Amongst the Monbutto, west of Uganda, Schweinfurth (*Heart of Africa*, ii., 87) remarks :—

"The growth of their plantain (*Musa sapientum*) gives them very little trouble; the young shoots are stuck in the ground after it has been slackened by the rain, the old plants are suffered to die down just as they are ; and this is all the cultivation that is vouchsafed. In the propagation of these plantains, however, the Monbutto have a certain knack of discrimination for which they might be envied by any European gardener; they can judge whether a young shoot is capable of bearing fruit or not, and this gives them an immense advantage in selecting only such shoots as are worth the trouble of planting."

More recently beyond Yambuya, in the heart of the great tropical forest, Mr. Stanley (*Darkest Africa*, i., p. 252) found "a clearing three miles in diameter abounding in native produce and hitherto unvisited by the Manyuema. Almost every plantain stalk bore an enormous bunch of fruit, with from 50 to 140 plantains attached. Some specimens of this fruit were 22 inches long."

Also at Indeman (vol. ii., p. 55): "The plantain groves were extensive and laden with fruit, and especially with ripe mellow plantains whose fragrance was delicious."

And in approaching Andata and Andikumu "in half-an-hour the main body of the caravan filed in, to find such a store of abnormally large plantains that the ravenous men were in ecstasies."

While at Ngoti above Urigi (vol. ii., p. 383): "A fine bunch of bananas could be purchased for 10 cowries, and as 8 cowries constituted a day's ration allowance, no one could possibly complain of insufficient food."

Dr. Parke speaks of "grim starvation" and "grim despair" which overtook the expedition (*Equatorial Africa*, p. 113), and rejoices at last in the "great luck" which brought it within reach of the generous plantain trees. "Just opposite our camp were some plantain trees. On making the discovery all the men were rowed across the river; they returned in the evening with a great quantity of bananas, which were greedily devoured. The men were served with 75 plantains each; they were not, however, very large or substantial; I disposed of 20 at one sitting without any prominent ill-effects."

In Mr. Morris's Report on the Island of St. Helena, pp. 26–27, the following note is given on fruit-bearing Musas: "The banana is grown to a small extent, but owing to the destructive influences of wind they do not bear so abundantly as they should. The small Chinese banana (*Musa Cavendishii*) is best adapted for cultivation in St. Helena, but with the exception of one or two plants it does not appear to have been largely tried. Being a small plant, seldom more than 5 to 6 feet high, it would grow well under shelter of a wall or side of a house, and under these circumstances it would be more satisfactory to grow than the taller kinds."

The plantain described as "a highly esteemed vegetable rather than a fruit appears to be absent from St. Helena. At least no plants came under my notice. Suckers might be obtained from the West Coast of Africa. It would require shelter, and a moist and somewhat rich soil. The latter conditions are easily attained in Jamestown, at least by irrigation."

For general notes on the cultivation of the banana and plantain in the West Indies reference might usefully be made to Dr. Nicholls' *Tropical Agriculture* (London: Macmillan, 1892), pp. 159–165. It is interesting to note that on the authority of Ovideo bananas were introduced by Father Thomas of Berlangas from the Canaries into San Domingo in 1516, whence they were introduced into the other islands and the mainland of tropical America.

Hughes (*Barbados*, p. 183) gave, so long ago as 1750, a very clear account of the cultivation of the plantain in that island:—

"Before the mother tree decays two or three large suckers or young trees grow up from the root. The largest of these, in about a twelvemonth's time, bears such another bunch of plantains as above described; and as this likewise dies, after it hath produced fruit, there springs from the root fresh young shoots; so that there is an annual succession of trees without any trouble to the planter. However, it is thought the most prudent method to replant them once in seven or eight years; in doing this to great advantage the situation must be rich and sheltered from the wind; and the land intended for this purpose must be dug in holes 2 feet deep, 1½ broad, and 12 feet asunder. These being well manured large roots of superfluous plantain trees are cut through in two or three pieces; one of these is put in every hole, slightly covering it with earth, in a short time it springs up. Another common way of propagating these trees is to dig up other young ones, which in great number are to be found growing about the roots of old decaying trees, and cutting off the top of these within 3 feet to the root, and so transplant them into holes prepared for that purpose."

Jamaica.—According to the *Jamaica Handbook*, 1881, pp. 181–182, bananas do well under irrigation near Spanish Town. The cost of clearing the land, opening irrigation trenches, buying suckers at 2*s.* per hundred, planting, cleaning eight times in the year, and all expenses up to the end of the first year was estimated at about 10*l.* per acre. The yield of marketable bunches was 25 per cent. less than the number of suckers planted. "No returns should be counted upon for the first

12 months, and the yield will vary considerably according to the nature of the soil. . . . . One field of 10 acres gave in the second year a return of 240*l.* net, whilst another field of 18 acres gave a net return of only 70*l.*" This disparity was due, not only to an original difference in the character of the soil but to the fact that the latter field had been already cultivated for some years previously, and the vegetable mould (so essential to the growth of the banana) had been exhausted.

In a note by Mr. Henry Cork on banana cultivation, reproduced in the *Bulletin of the Botanical Department, Jamaica* (1893), 49, p. 2, it is stated that plants on level land that can be ploughed are put out at 14 feet square; the rows are kept perfectly straight. The suckers allowed to remain for future crops are carefully selected at regular intervals, from two to four months (according to the quality of the soil), all others are removed. If too many suckers are left the bunches take longer to mature and hence the fruit will not be ready early in the spring when good prices are obtainable. The land requires to be weeded, ploughed, and harrowed seven times during the year, forked round the roots once a year, and have the redundant suckers removed regularly as they appear. The actual gross returns on good land thus cultivated (with 339 stools to the acre) was 27*l.* 1*s.* 3*d.* per acre. The cost of cultivation and delivery per acre was 6*l.* 18*s.* 6*d.* The net profit per acre was therefore 20*l.* 2*s.* 9*d.* Forty acres of this estate had been bearing since 1886 and were still in cultivation. The net profit realised on the particular estate above mentioned was probably exceptional. On the other hand it shows what high cultivation and judicious management can do in the production of bananas in thoroughly suitable localities in Jamaica.

In Trinidad Dr. de Verteuil says:—

"The plantain requires a good deep soil and a sheltered position, being easily prostrated by strong winds. It is propagated by sprouts (improperly called slips) which are planted at 10 feet apart. From five to seven of these young shoots or suckers spring out of and around the parent stem. The fruit, or rather the bunch of fruits, makes its appearance between eight, nine, and twelve months. The young shoots then give their fruit in succession, for two, three, or even many years, according to the climate, fertility of the soil, and the care bestowed on them. A plantain 'walk' requires only occasional weeding and pruning."

In British Honduras the cultivation of bananas and plantains has become an important industry. In fact the fruit exports are now almost two-thirds of those of the great staple industry of the colony—mahogany. Further it is stated (*Kew Bulletin*, 1894, p. 98) that "the one cheering fact in the agricultural condition of British Honduras at the present time is the gradual and steady development which has taken place during the last few years in the fruit trade."

In the early stages of this enterprise the following suggestions were offered by Mr. Morris (*Colony of British Honduras*, pp. 92, 93) with a view to establish successful plantations:—

"Owing to the regular fortnightly communication by mail steamer between British Honduras and New Orleans, a large demand has arisen for bananas, coco-nuts, oranges, pine-apples, and various other fruits for the American market. At present, next to sugar, bananas would appear to be occupying chief attention in the Colony, and provided a convenient and regular market is found for the produce, planters have every prospect of finding the cultivation a profitable one.

"The profits on banana cultivation would appear to range from 12*l.* to 15*l.* per acre, after the lapse of 12 to 18 months. The cost of establishing a plantation, including the price of land (at a dollar an acre) will not exceed some 8*l.* to 12*l.* per acre until the first crop is reaped.

"There are some thousands of acres of splendid land suitable for banana culture in this colony, which offer every inducement to experienced tropical planters to settle down and reap the returns which must inevitably attend the judicious and careful culture of this fruit. Practically, the export trade in bananas has only arisen since steam communication was established with America. The export in 1880 was 8,958 bunches of bananas, of the value of 700*l.*; in 1881 it had risen to 22,229 bunches, of the estimated value of 1,469*l.*"

[It has since attained large and increasing proportions, and the annual value now is not less than 40,000*l.*]

A later account, written from personal experience, of banana planting in British Honduras, was contributed to the Demerara *Argosy* by Mr. W. Van Diepen. The chief points of interest may be briefly summarised as follows:—*Planting:* The suckers are put out at 18 feet by 18 feet. This wide planting is claimed to be ultimately advantageous in producing fine large bunches as well as in affording space for the cultivation of cacao, rubber, and other plants of a more permanent character. Bananas so planted give 134 stools to the acre. The largest suckers only are used and care taken not to injure the eyes. When suckers are produced all except two or three of the strongest are recommended to be destroyed. "This is done by bending them down, and on no account should a cutlass be used, as cutting them down bleeds them, and consequently takes away the strength of those left."

Reaping: The bunches should be left on the trees, if possible, until the day before shipping. During the cooler months, November to April, the bananas are cut much fuller than during the hot months. "Fruit cut too full in the summer does not last the four days' voyage to New Orleans." The period which usually elapses from the time the sucker is planted until the bunch is reaped is twelve months. "After the bunch is cut the planter may with safety expect two or more bunches from shoots on the same stool during the next nine months." Each bunch may weigh from 30 to 90 pounds.

Replanting: Unless the banana plant is required to shade other plants the fields should be re-planted every five years.

Protection from wind: High winds are injurious to banana crops. Hence cultivators should leave a belt of forest and under-bush to protect the plantation on the north and east. Stems with large bunches should be supported by sticks or bamboos.

Shipping the fruit: Winter is the best market time for bananas in the United States, the fruit keeps longer in good condition for the voyage and subsequent handling on land. In order to obtain fruit in December the grower should plant at the end of November, that is, 12 to 13 months previously. The months of June, July, August, and September are the worst for shipping bananas. In British Honduras the contractors pay 50 cents, Belize currency, equal to about 1*s.* 6*d.* for bunches of eight hands and upwards, and half that price for bunches under eight hands; bunches of six hands are very seldom saleable.

The United States Consul at Belize in 1893 reported: "The capital required to start a fruit plantation is comparatively small, and, the revenue gained from it when in full bearing being large, many men who were formerly labourers now own plantations on the banks of the various rivers and also comfortable town houses. All the fruit grown here is shipped to the United States, and the steamers which buy the fruit from the grower bring in exchange all the food stuffs which are consumed in the Colony."

The later developments in fruit-growing in **Nicaragua** are described by Mr. Consul Bingham, in a Foreign Office Report, No. 92, 1888, on the cultivation of bananas on the Rama River, Nicaragua :—

"The first shipment, consisting of about 500 bunches, was made in the latter part of 1883, the fruit being sold at the vessel's side at the rate of 50 cents (Nicaraguan currency) per bunch. The success that attended this first attempt induced many persons, including several foreigners, to commence the cultivation of bananas, and now the whole of both banks of the Rama River, commencing from about 20 miles from the Bluefields Lagoon up to the junction of the Rivers Escondido and Sequia, and such parts of the last-named rivers as are navigable for canoes, have been cleared and cultivated. The banks of the Rama River, for about 20 miles from Bluefields, are not adapted for cultivation, being too low and swampy. The following figures will show the rapid growth of the exportation of bananas from this country :—In 1883 the number of bunches exported was 8,000 ; in 1884, 40,000 ; in 1885, 45,147 ; in 1886, 154,434 ; and in 1887, 255,332.

"To ship the bananas during the year 1887 there were six steamships, each making monthly trips to the United States, where the whole of the fruit is sold, two of these steamers carrying their cargo to New Orleans, three to Baltimore and Philadelphia alternately, and one to New York.

"A plantation of 10,000 bananas would cost, including clearing the ground and planting, about 10,000 dollars currency. It would commence to give fruit in 9 or 12 months after planting, and would last about five years ; after that time the ground becomes exhausted, and the fruit so poor as to be unmarketable. The bananas grown on the Rama River are the ordinary yellow banana, about 6 to 8 inches long, and a red variety known as the 'patriota.' This is smaller than the yellow form, but has a sweeter and finer flavour."

In **Venezuela** Diaz states that the plantains and bananas of that country thrive very well, the only drawbacks in certain localities being strong winds and occasional prolonged droughts. The soil best suited to them should be somewhat moist and provided with humus. As regards temperature the hotter it is (with abundant moisture) the better ; hence the luxuriance of the plants along the sea coast.

In propagating it is important the suckers should not be removed until the parent stem has perfected its fruit, otherwise the latter will not fully mature. Suckers are put out at a distance of 9 or 12 feet, according to the fertility of the ground, and they are disposed "in equilateral triangles." During the first year the ground could be utilised for the growth of maize, peas, beans, and other crops between the rows. The weeding and clearing should take place at the beginning of the rainy season and again "at the commencement of the north winds," that is twice a year, in the months of April and September respectively.

At **British Guiana** Messrs. Harrison and Jenman write :—

"The banana is a gross feeder and requires liberal cultivation. A copious rainfall, good soil and tillage, free drainage, and liberal dressings of manure where the ground is permanently used, are all essential conditions to the production of first-class fruit. When stable dung is procurable its application pays well. In the experiments we have tried with artificial manures, sulphate of ammonia, applied about 2 cwt. to the acre at a time, appears to have produced the best results. Enormous show bunches of any of the heavier yielding kinds may be obtained by planting in a stable-manure heap or ordinary dung-hill. One caution may be mentioned. The plant tillers (or suckers) so freely that constant attention is required to keep down the superabundant shoots. The taller kinds should not exceed 300 stools to the acre, and if allowed to 'ratoon' much, less would be advantageously planted. The small fig and the dwarf or Chinese may be placed closer, but not if many suckers be allowed to grow. As the bunches of the latter hang down nearly to the ground, all animals, including poultry, must be kept away from them. The tall kinds should be supported with a forked stick or two, placed under the neck of the bunch on the side which it hangs and leans to, strong enough to support the weight.

"Plantains require much the same system of cultivation as that described for bananas, but give a heavier yield from the same land. They delight in the stiff, newly empoldered clay lands of this colony, not objecting to the slightly saline element found where the sea or river has invaded the place periodically at spring tides while it was lying fallow under the natural bush growth. Such lands yield heavily, but the crop is liable to suffer, if the seasons for the first two years after planting prove very wet, from the plantain disease of the colony."

Again "new lands produce the most luxuriant plantain growth, and are used for this purpose by estates, as they will not at first grow canes well, but after a few years of plantain and ground provision cultivation they become adapted to the requirements of sugar-cane cultivation. Plantains growing on 'pegass' land (containing a large admixture of vegetable mould) are reported to be better flavoured than those grown on purely clay land, upon which, however, for commercial purposes they are almost exclusively grown."

Mr. A. D. Van Der Gon Netscher, when proprietor of plantation *Klein Pouderoyen*, on the west bank of the River Demerara, in 1855, furnished the following interesting particulars relative to the cultivation of the plantain : "The experience of ten years on a cultivation of from 400 to 480 acres in plantains has shown that—1. On a well kept cultivation every acre will give 300 good and 50 inferior bunches of plantains per annum. 2. On every acre 400 suckers are planted at intervals of 12 feet, in rows nine feet apart, a closer planting having proved to be injurious to the growth of the fruit and the development of the stem. 3. Of the suckers planted not more than 75 out of 100 succeed, and the deficiencies require to be supplied. The cultivation will give on an average five good crops of fruit in two years. 4. The keeping up of a plantain estate, on a large scale, costs about 6*l*. per acre per annum, supposing the estate to be already in good working order."

CULTIVATION OF BANANAS IN ENGLAND.

Bananas are common objects of cultivation under glass in this country, but they are grown more for their handsome foliage than for the fruit, since they occupy considerable space in hot-houses, and require a high temperature all the year round. At Kew, Sion House, Chatsworth, and many other establishments with spacious "palm" houses, plants of large size are grown, and under these circumstances they fruit freely.

M. Ensete and *M. Basjoo* form very striking plants at Kew in the Temperate House. *M. Ensete*, according to Sir Joseph Hooker (in *Gard. Chron.* 1860, p. 1105) ripened a few seeds in the Palm House in that year. The female flowers were specially fertilised with pollen taken from the scarcely opened male flowers. The Palm House affords the most suitable conditions for the tropical species. Some fine specimens of *Musa sapientum* attain a height of 18 feet to 20 feet. Their large, emerald green leaves remain unbroken, in marked contrast to their usual condition in the tropics, until they begin to fade. The most esteemed sorts for fruit purposes are selected from time to time for distribution to botanical institutions in the Colonies. Of these the "champa" and "râm kela" (or *rubra*), two choice Indian sorts described by Firminger, have been distributed from Kew during the year 1893. A Malayan sort, "pisang medji" (*M. mensaria*, Rumph.), with a sub-globose fruit, as large as an apple, and soft yellow flesh is very palatable. Another Malayan sort "pisang raja" (*M. regia*, Rumph) with a fruit as long as a man's finger, an inch thick, is very sweet and delicate in taste. To these may be added a sort from Madras called "rustali," generally sold as a table plantain in that Presidency, though by some it is not thought of such good quality as the "guindy."

A bunch of the Chinese banana grown by Sir Henry Peek, exhibited at a meeting of the Royal Horticultural Society in 1877, weighed 98 pounds, "a result," according to the *Garden*, XI., p. 345, "which proves that we may enjoy this, and possibly other tropical fruits, fresh from our own garden, if we desire to do so."

Graham (*Bot. Mag.*, t. 3849) refers to the success which had attended the cultivation of many forms of bananas, at Edinburgh in 1840, under the management of Mr. McNab, and he specially mentions the immense quantity of high-flavoured fruit which had been produced.

At Parkfield, near Worcester, according to the *Gardeners' Chronicle*, 1894 [1], p. 340, two plants of *Musa Cavendishii* "were carrying clusters of fruit weighing between 80 and 100 pounds each."

Mr. W. Watson, the Assistant Curator, gives a brief account of the treatment of bananas at Kew as follows :—

"A selection of edible-fruited Musas is cultivated in the Palm House at Kew, in addition to the collection of species, of which 20 of those recognised in this paper are represented in the various houses. With scarcely an exception they are all easy to cultivate; they like rich soil, a fair allowance of root-room, plenty of sunlight, and liberal supplies of water. The deciduous species, represented by *M. superba*, are kept quite dry during winter. *M. Cavendishii* does not fruit as well in the Palm House as it does at Sion House and in other gardens, but all the forms of *M. sapientum* fruit well at Kew. They are planted either in large tubs or in a border on the south-east side of the house in a compost of rich loam and cow manure. Suckers about 6 feet high, when planted singly, fruit in from two to three years. The bunches are cut as soon as the fruit shows signs of changing from green to yellow and hung in a warm room to ripen. This they do in about a fortnight after cutting. Fruit ripened on the plants is not nearly so rich in flavour as when it is cut and ripened in a room; it also ripens much more slowly if left on the plants. As soon as a bunch is cut the stem which bore it is cut off level with the ground and a sucker, of which there are generally several in various stages of growth, is selected to take its place.

"Travellers who have tasted some of the best of the Kew-grown bananas, say that they are superior in flavour to what are obtainable in the tropics."

Mr. George Wythes, gardener at Sion House, has lately given the results of his experience in growing bananas, in the *Garden*, Vol. XLIV., pp. 496–497. One of the best sorts recommended to grow for fruiting purposes is the Chinese banana, *M. Cavendishii.* A sort grown at Panshanger Gardens called Lady's Finger is also described as a first-class fruit with an excellent flavour. The taller sorts are not in favour in conservatories as they take up too much room.

"When grown in a high temperature bananas require an abundance of moisture. Plants may be fruited in 12 months if well cultivated and large suckers are planted in the first instance. They like good stout loam and an abundance of food. As soon as the fruit is formed surface dressing with cow manure is recommended and Thomson's vine manure mixed with the compost. Fish manure is also excellent. After fruiting the old stem or stool should be removed and the sucker detached. The border is then cleared out and filled with new soil for subsequent planting."

The plantain is not usually grown under glass for the sake of its fruit. Should it be accidentally introduced and fruited it is regarded by those not acquainted with its merits as simply an inferior sort of banana and it is discarded. If there were such a plant as a dwarf plantain yielding a first-class fruit suitable for cooking it would be very desirable to introduce it.

DISEASES OF PLANTAINS AND BANANAS.

As a rule, both plantains and bananas are singularly free from disease. Taking into account the immense areas over which these plants are cultivated, and the lengthened period during which they have been subject to the control of man it is remarkable that no chronic disease has manifested itself amongst them except in one or two localities.

Queensland.—Dr. Bancroft in 1879 investigated a disease in the neighbourhood of Brisbane. The plants were said to be *Musa maculata*, the *figue mignonne* of Mauritius and Bourbon, and the "sugar banana," possibly a form of *M. sapientum.* He found the roots affected with what he called the "flash worm," a species of nematoid worm allied to the well-known paste eel *Anguillula.* He recommended as a remedy "ploughing up and summer fallow." Of late years little has been heard of this disease. Nothing apparently is so efficacious as changing the ground from time to time and planting with healthy suckers from unaffected districts.

A fungus (*Glœosporium Musarum*, Cooke and Massee) affecting ripe bananas in Queensland was forwarded to Kew by Mr. F. M. Bailey, F.L.S. (No. 520). This disease is capable of spreading very rapidly on living plants, and as a "black smut" it may be readily detected. The only effective treatment is to destroy the plants immediately by burning or by the liberal use of lime.

Fiji.—In the Governor's report for the year 1889 it was stated, "A disease has appeared among the banana plantations in these islands during the past six or seven years, and it would make rapid strides but for the persistent watchfulness of the growers. No reliable cure has yet been found, but inquiry and experiment are still going on." The subject was discussed in *Kew Bulletin*, 1890, pp. 272–273.

Sir John Thurston stated that the disease broke out in the first instance on the small island of Yanuca, used as a quarantine station. It is possible it was introduced in some way by immigrants. It spread from Yanuca to the neighbouring island of Moturiki. Here *Musa Cavendishii* (largely grown in Fiji for export), was first attacked, but in the course of a few months the larger and stronger plantain was affected, and ultimately not a single banana or plantain could be found from one end of the island to the other. The disease then passed over to Viti Levu and was carried by various agencies all over the country. No place, however, suffered as Moturiki did. The Governor was able to report in 1891 that after a period of rest the land even there was able to grow plants almost free from disease.

It was believed that the Fiji disease might be caused by a nematoid worm, a minute parasite similar to that found in Queensland attacking the roots. It was recommended, failing success with various insecticides, to plough the land, leaving it fallow for a time and alternating some other crop. The ground was subsequently to be replanted with suckers from an unaffected locality. The view that the disease was caused, in part at least, by nematoid worms was apparently confirmed by investigations with fresh material undertaken by Dr. N. A. Cobb at Sydney, New South Wales. The results are given in *Kew Bulletin*, 1892, pp. 48, 49. The remedies suggested by Dr. Cobb were:—

"1. Where the bananas are cultivated, a system of rotation should be adopted; no attempt should be made to grow banana plants on the same ground continuously for a long series of years. . .

"2. Judging from the specimens sent, the soil about the banana plants is infested to an extraordinary degree with nematodes, therefore it is best, in cultivating, to plough deeply, or to occasionally subsoil the land. These nematodes attack the roots of plants, and exist largely within 8 inches of the surface. As they become rarer as the depth of the soil increases, it follows that if the land be ploughed deep and thoroughly so as to turn the soil exactly bottom side up, a soil comparatively free from nematodes will be brought to the surface, and, at the same time, the nematodes which were near the surface are buried so deep that they can do much less damage than they could if left at the surface.

"3. . . . The main difficulty in dealing with these plants is thought to be due to the attacks of the fungus, and here the best remedy is great care in setting the new suckers, *i.e.*, in making new plantations. The presence of the fungus is indicated by discolouration in the rootstock. Now, when suckers are cut off from the old plant with a spade, they should be inspected, and all brown and rotten portions should be carefully removed, and all suckers from which these brown and discoloured portions cannot be removed should be discarded."

British Guiana.—A disease of plantains has long been known in this Colony. Diseased stems exhibit internal decay, the substance of the leaf sheafs "turning to a sodden, offensively-scented, putrid mass." The fruits produced by the diseased plants "are black inside, but not soft like the interior of the stems and rootstocks of the plants. They are of course unfit for food." The nature of the disease, according to Mr.

Jenman, has not yet been determined, though it has been studied closely in the fields, and samples of the affected parts have been examined by mycologists. Very wet weather materially increases its prevalence on heavy new land, and good drainage and high planting can be resorted to as a protection from its ravages. It is said that cocoa-nut palms in British Guiana are affected by the same disease as the plantains.

An obscure disease of cocoa-nut trees at Montego Bay, Jamaica, may be related to it. Mr. Fawcett, describing the Jamaica trees, states, "in almost all the trees examined the sour smell of a putrefactive fermentation was very noticeable, and I am of opinion that the disease is due to an organised ferment which is able to attack the very tender tissues of the youngest parts even outside the terminal bud. If this ferment can be destroyed by fire or other means before it reaches the terminal bud in the heart of the cabbage the tree may be saved." The only remedy at all effective was "burning the leaves on the trees in the early stages of the disease." It was recommended to destroy all diseased trees, and for those under treatment it was suggested to apply to their roots the ashes of the burnt leaves mixed with some manure.

The bananas in British Guiana are apparently not affected in the same way as the plantains. Some plants here and there growing near diseased plantains are affected, but the bananas as a rule are free from disease.

As far as can be gathered the plantain disease is more pronounced on the "newly empoldered clay lands of the Colony." This land, with stiff, tenacious soil, is strongly impregnated with salt, and it will not grow sugar canes. It is possible such conditions may serve to render the plantains susceptible to the disease if not directly the cause of it. It has been shown that plants affected by the disease grown experimentally in the Botanic Gardens at Georgetown, in comparatively poorer but drier and more cultivated soil, have "lost the affection from the first, and bore "without exception sound fruit."

Trinidad.—The following information by Mr. J. H. Hart, F.L.S., on this subject is taken from the *Bulletin* of the Royal Botanic Gardens, Trinidad, No. 21, January 1894 :—

"For some two or three years past a disease has appeared among the various kinds of Musas cultivated in Trinidad. It is characterised by a diseased condition of the leaves, and by the fruit rotting before coming to maturity.

"The kinds most affected are those known as the 'Moko,' or 'Jumbi plantain,' and the 'Jamaica banana,' otherwise known in Trinidad as the 'Gros Michel,' which is the kind most generally exported to the United States.

"I have several times examined diseased plants at various seasons, but so far am unable to point to any special cause. When first affected the plant shows signs of disease by the decay or shrivelling up of its leaves, and a general weak appearance; the base of the petiole also rots away into a state of fermentation. The watery sap of the plant teems with amœboid organisms, and nematoid worms are present in large numbers, while a variety of forms of bacteria are present in the fluids of both stem and leaf.

"These organisms also appear in the soil surrounding the roots, and also in the fruit when it decays. I have, however, been unable to show that the plant is attacked by parasitic fungi of any kind.

"So far as my observation goes the disease first attacks the growing parts of the plant, and then induces decay downwards to the roots, the whole stem eventually rotting.

"As a tentative measure I would suggest the complete destruction of infected plants, and the removal of all that are healthy to well-drained and fertile soil.

"It is observed that the 'fig-sucré,' or small-fruited banana, enjoys the greatest immunity from attack; possibly on account of the harder character of the epidermis in this variety."

South-East Africa.—Although the fruit-yielding Musas are not cultivated to any extent in Cape Colony, specimens of diseased banana fruits were received from Professor MacOwan in 1893 grown near East London. The disease was very similar, if not identical, with that caused by a species of *Glœosporium* in Queensland. It affects both the flowers and fruit, and seems to be general. A growing plant infected in the Laboratory at Kew with the spores of the fungus soon showed the disease in a virulent form. It is therefore desirable to carefully watch banana plants affected by any forms of "black smut," and to destroy them immediately, before the disease has had opportunity to spread.

ECONOMIC USES.

Ripe bananas, especially the delicate sorts, are an excellent dessert fruit, and they are universally used in the tropics. The taste and flavour of the banana fruit are very various. Some are acidulous, others acid-sweet or sweet like sugar. In the best varieties the pulp is soft and melting, with a delicate fruity flavour resembling apple, strawberry, or pine-apple. The taste for ripe bananas of late years has largely spread to temperate countries, and to supply the demand an enormous trade has sprung up between the West Indies, especially Jamaica, and parts of Central America, to ship fresh fruit to the United States and Canada. During the year 1893 the aggregate quantity received at ports in the United States reached nearly 13 million bunches. The value of this fruit at the wharf would not be far short of four millions sterling. The quantity received at ports in the Dominion of Canada is not given, but it must be steadily increasing since direct steamers have now been placed between Canada and the West Indies. The consumption of bananas in this country and on the Continent is as yet comparatively small.

Dampier, during his "New Voyage round the World," 1679 to 1691, recognised the value of the plantain and banana. "The plantain," he says, "I take to be the king of all fruit, not except the coco[nut] itself. The trees are not raised from seed (for they seem not to have any) but from the roots of other old trees. If these young suckers are taken out of the ground and planted in another place it will be 15 months before they bear; but if let stand in their own native soil they will bear in 12 months. As soon as the fruit is ripe the tree decays."

Again, "When this fruit is only used for bread, it is roasted or boiled when it is just full grown, but not yet ripe, or turned yellow. . . . Sometimes, for a change, they eat a roasted plantain and a ripe raw plantain together, which is instead of bread and butter. They eat very pleasant so, and I have made many a good meal in this manner. Sometimes our English take six or seven ripe plantains, and, mashing them together, make them into a lump, and boil them instead of a bag-pudding, which they call a buff-jacket ; and this is a very good way for a change. This fruit makes also very good tarts; and the green plantains sliced thin, and dried in the sun and grated, will make a sort of flour which is very good to make puddings. A ripe plantain, sliced and dried in the sun, may be preserved a great while, and then eats like figs, very sweet and pleasant. The Darien Indians preserve them a long time, by drying them gently over the fire, mashing them first, and moulding them into lumps. The Moskito Indians will take a ripe plantain and roast it ; then take a pint and half of water in a calabash, and squeeze the plantain in pieces with their hand, mixing it with the water ; then they drink it all off together; this they call *mishlaw*, and it is pleasant and sweet and nourishing, somewhat like lambs-wool (as it is called) made with apples and ale ; and of this fruit alone many thousands of Indian families in the West Indies have their whole subsistence."

Coming to later times Lunan in *Hortus Jamaicensis*, p. 74, quoting Labat, says: "When the natives of the West Indies undertake a voyage they make provision of a paste of banana, which, in case of need, serves them for nourishment and drink ; for this purpose they take ripe bananas, and, having squeezed them through a fine sieve, form the solid fruit into small loaves, which are dried in the sun or in hot ashes, after being previously wrapped up in the leaves of Indian flowering reed. When they would make use of this paste they dissolve it in water, which is very easily done, and the liquor, thereby rendered thick, has an agreeable acid taste imparted to it, which makes it both refreshing and nourishing."

In the green state and cooked in various ways plantains supply the staple food of millions of people in tropical America. In fact "they are so extensively consumed as to almost take the place of cereal grains as a common article of diet. About 6½ pounds of the fruit or 2 pounds of the dry meal with a quarter of a pound of salt meat or fish form in the West Indies the daily allowance for a labourer." In Jamaica the working negroes prefer plantains to bread ; the former they boil or roast in ashes and eat when quite warm. The ripe fruit when it is yellow and has acquired a sweetish flavour is sliced and fried or baked. It has then a pleasant sweet flavour, slightly acid, and very much resembling baked apples.

In Central America, according to Seemann, the plantain furnishes the inhabitants with the chief portion of their food. Similarly we have the testimony of Belt that "Next to maize, plantains and bananas form the principal sustenance of the natives in Nicaragua. There are a great many varieties of them, and they are cooked in many ways, boiled, baked, made into pastry, or eaten as a fruit. The varieties differ, not only in their fruits, but in the colour of their leaves and stems."

Usually the bunches of fruit, both in the plantain and the banana, are cut before they are quite ripe, or when the first fruits are beginning to turn yellow. They are then hung up to ripen gradually under cover. There are, however, other methods adopted. The plantains especially, are sometimes taken from the bunch and packed loosely in a hole in the ground and well covered over. In this way they become softer and have a better appearance than if dried in the sun. When a hole is not available they are placed in a barrel in straw and also covered over. Monteiro, who travelled in Angola, refers to the domestic uses of the fruit as under :—

"The plantain is roasted green when it becomes quite dry and a good substitute for bread; or boiled, to eat with meat instead of potatoes; and when ripe roasted whole or cut lengthways into thin slices and fried in butter and eaten with a little sugar and cinnamon or wine forming a delicious dish for dessert. A very large plantain, 18 or 20 inches long, is cultivated in the interior, and is brought down to the coast by the Tombos."

Speke, in his *Nile Journal*, p. 648, enumerates the uses of plantains in Central Africa: "A chip from the stem washes the hands, and makes the wet flesh-rubber of the Waganda; thread and lashings for loads are also taken from the stem; rain is collected in the green leaves, which can be made into an ingenious temporary pipe; the dry leaves make screen-fences and sacks to hold grain or provisions; the fruit dried (from Ugigi) is like a Normandy pippin; a variety, when green and boiled, is an excellent vegetable, while another yields a wine resembling hock in flavour. At 2° N. they cease to be grown."

In Fiji "The fruit of the different Musas is," according to Seemann, "variously prepared by the native cooks. Split in half, and filled with grated cocoa-nut and sugar-cane, bananas make a favourite pudding (vakalolo), which, on account of its goodness and rich sauce of cocoa-nut milk, has found its way even into the kitchen of the white settlers. Wilkes has already mentioned that the natives, instead of hanging up the fruit until it becomes mellow, bury it (occasionally, it should be added) in the ground, which causes it to appear black on the outside, and impairs the flavour. The fresh *Musa* leaves are used as substitutes for plates and dishes in serving food or for making temporary clothing, the dry instead of paper for cigarettes (suluka). In place of the finger-glasses handed round at our tables after dinner, Fijians of rank are supplied with portions of the leaf-stalk of the plantain."

Seemann continues: "The Fei, or mountain plantain, beaten into a pulp and diluted with cocoa-nut milk or water till brought to the consistency of arrowroot as ordinarily prepared in England, was formerly much used in the Society Islands. Large quantities were usually prepared for every festival; a kind of cistern was made, with a framework of wood and a lining of leaves, which, when filled, was a sufficient load for six men to carry. Seven or eight of these were sometimes filled and carried on men's shoulders to one feast."

Moseley in "Notes of a Naturalist," confirms this interesting account of the Fei. In Tahiti he and his companions made "the first camp in the head of Fatua Valley at a height of about 1,600 feet amongst the 'Fei' or wild plantains . . . . The plant is closely similar in appearance to an ordinary banana tree, but the large bunches of fruit instead of hanging down stand up erect from the summit of the stem. They are bright yellow when ripe.

"A fire is lighted and a bunch of these wild bananas is thrown into it. The outer skin of the fruit becomes blackened and charred, but when it is peeled off with a pointed stick a yellow floury interior is reached, which is most excellent eating and like a mealy potato. This is one of the very few plants which, growing spontaneously and in abundance, affords a really good and sufficient source of food to man. Hardly any improvement could be wished for in the fruits by cultivation. It could not but be most advantageous that the plant should be introduced into many other tropical countries."

In the West Indies the dried leaves and prepared portions of the stem are used as a packing material for the fruit when taken down to the nearest port for shipment. The same material is woven into coarse saddle-cloths for pack mules, or used in a loose pad for the same purpose. The fresh banana leaves are used to shade young coffee or cacao seedlings in nursery beds, and to cover the cacao beans during the process of fermentation. The midribs are often placed in the syrup of Muscovado sugar when first poured into casks to assist to drain the molasses. The young leaves before they open are beautifully smooth and soft, and are used as a dressing for blisters; while the juice, according to Barham, "is good against burn." The water from the soft trunk is astringent and employed to check diarrhœa. The juice from the skin of the green plantain, says Lunan, when cut forms a good cement for broken china or other earthenware. Long remarks that the juice [probably a pectose] which drops from a bunch of bananas hung up in the shade to ripen makes a very good vinegar. Hughes (*Barbados*, p. 182) mentions that "the pulpy stem of bananas are often sliced and given by way of fodder to cattle."

The inner undeveloped leaves, when quite white and tender, as well as the flower or scape buds, are not infrequently eaten in the East Indies. Kurz states that these miniature portions of the plantain (probably from wild plants) are brought into the Calcutta bazaars to the amount of half a ton daily. They are known as *thor* and are prepared for food by boiling. Firminger possibly refers to something similar when he states that "The head of the flowers of a variety of plantain known as *Kuntela* in the neighbourhood of Calcutta before the sheath in which they are enclosed expands, is often cut off, being esteemed a most delicate vegetable." This use does not appear to have extended to tropical America, or at least we have met no record of it, probably on account of the absence there of wild plants in the abundance found in the East. In other parts of India also the young flower-heads are cooked and eaten in curries. The use of these portions of the plantain stems for food is similar to the use in many parts of the world of the leaf buds (or the cabbage) of many palms. There is, however, a curious species of *Musa* already noticed from New Caledonia (possibly altered by cultivation) described by Vieillard under the name of *M. oleracea*. It produces no inflorescence and is cultivated on account of its fleshy and farinaceous rhizomes which are cooked and eaten. It is multiplied entirely by offsets. The infant spadix or scape of the Abyssinian plantain (*M. Ensete*) is also used as a vegetable. The young stem is first of all deprived of all its external envelopes and is then cooked and eaten. "Prepared in this way, it resembles the cabbage of a palm." The plant is of great importance for food purposes as a vegetable in the damp valleys of Abyssinia, notably in the Soudan. It extends also up the Nile Valley almost to the equator. The fruit, as already mentioned, is usually regarded as not edible.

Johnston, however, in his Kilima-njaro Expedition met with a singular use of the seeds of the *Ensete*. He remarks that in the inside of the seeds is a friable white pith easily rubbed into a white powder by the natives. "When in this state it is used for divinations and augury by being blown from the hand." He speaks of the very scanty pulp found in the fruit in a fresh state as "just eatable." It is "faintly sweet, but leaves a somewhat acrid taste in the mouth." Later on he says "it is supposed by the natives that the children grow up fine and tall if they eat of the pulp of the Ensete." A similar belief is said to prevail also among the natives of the Nyassa region. The black irregular-shaped glossy seeds, according to Captain Speke, are strung into necklaces, charms, and tiaras by the Waganda, and goats are fed on the leaves. Some of the economic uses described under *Musa Ensete* may, however, refer to other, but very closely allied, species.

In India the dried petiole of the plantain is used without further preparation for tying fences, training the betel vine to its support, and for numerous other purposes as a rough kind of twine, and the larger parts are made into little square boxes for holding snuff, drugs, &c. In the Archipelago the trunk is cut into several pieces, which serve as hearths during festivities in the open air, and in Siam it is used for clarifying sugar. The leaves are much used for packing all sorts of small goods in the bazaars, and are also employed as plates, being sold for this purpose for from 1 to 3 pies each. When dry they are employed by shop-keepers much as brown paper is in Europe. They are also used for making mats, and as thatch for temporary huts. In Central America "the mats which the poorer classes have to sleep upon are made from fibre of the plantain." In the Malay peninsula the fresh leaves are employed as a water-proof covering for the earthen pots or bamboo, in which rice is steamed. The ash of the leaf and the leaf stalk, rich in alkaline salts, is used instead of country soap or fuller's earth in washing clothes.

A solution of the ash is frequently employed instead of salt in cooking vegetable curries, &c. The shoots and tops of young plants are also occasionally eaten as a vegetable, and are given as fodder to sheep and cattle. The outer sheaths form a valuable fodder for elephants. The central portion of the stem and the root-stock are said to be given to cattle to increase the quantity of milk.

Dr. Dymock found a sweet translucent jelly-like manna exuding from the stem of *Musa superba*. This when dried at a low temperature yielded 82–3 per cent. of fermentable sugar.

Kurz mentions that "the skin of the plantain is generally used by the servants in Dutch India for blackening their masters' shoes." The watery juice which flows from all cut parts of the banana is rich in tannin, and it is of such a blackening nature as to be fit for being used as an indelible marking ink, the marks becoming black and visible only after washing. "One rarely emerges from the cloudy regions of Java (where the undergrowth is chiefly composed of wild bananas) without having his white clothes spoiled for ever owing to the juice that exudes from the injured parts of the banana plants. With the addition of iron it rapidly becomes black like ink."

Kurz further adds: "The *djantongs*, or sterile flower-cones hanging at the end of the scape, of most varieties are used in sayurs and curries, and so also are the flowers themselves in some parts of India." Junghuhn describes a wild plant called the wax banana of Java, the leaves of which are covered on the underside with a minute white powder. The Javanese scrape this meal together, melt it over a fire, and produce a valuable wax. The wax thus obtained becomes very clear, hard, and whitish, and forms an important article of trade in middle Java. Bleaching renders it very white. One banana tree (with seven leaves) yields two ounces of wax. As there are thousands and thousands of plants wild over large areas the preparation of the wax is a remunerative enterprise.

Dye and Tan.—The ashes of the leaves, the stem, and the peel or fruit rind are employed, according to McCann, in many of the dyeing processes practised in Bengal. The latter is also used as a tan and for blackening leather. The sap stains cloth a dark, almost black colour, which is fairly permanent, is very difficult to wash out, and on that account may be employed as a substitute for marking ink.

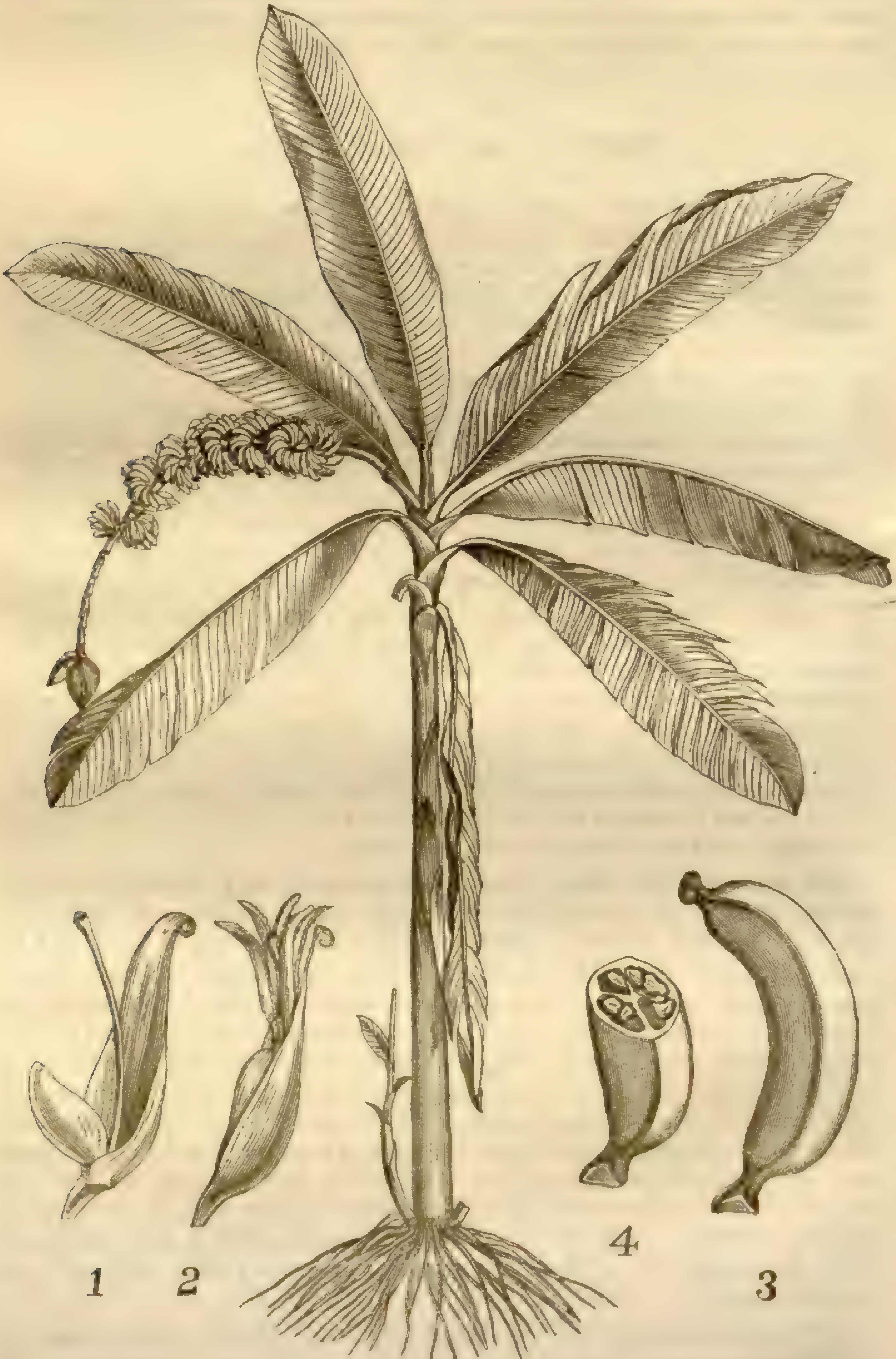
Amongst the specimens shown in the Kew Museum are the leaves of *Musa Fehi* dried for use as a packing material. The texture of these leaves is stouter than in the ordinary banana. Neat little cups woven from plantain leaves, as well as a native rope from the same material, are shown from Madras. Siamese "burees," or cigarettes, sold in Bangkok at 8*s*. 4*d*. per 1,000, with wrappers made from banana leaves, were received from Mr. F. W. Burbridge. Banana chutney, prepared at Natal, was shown at the Col.-Ind. Exhibition, 1886, while a sample of banana vinegar was received from Fiji at the same Exhibition.

PLANTAIN AND BANANA FIBRE.

The fibre produced by the stems of various sorts of Musas has received attention from the earliest times. Dampier noticed that at Mindanao, in 1686, "the ordinary sort of people wear cloth made of plantain-tree which they call *Saggen*, by which name they call the plantain." To prepare this cloth they cut the plantain stem into four quarters, "which, put into the sun, the moisture exhales; they then take hold of the threads at the ends, and draw them out; they are as big as brown thread; of this they make cloth, which is stubborn when new, wears out soon, and when wet it is slimy." About the beginning of this century the Government of Jamaica offered rewards of 200*l*. "for the best specimens of plantain hemp produced in each county of Jamaica." Dr. Stewart West, then acting-botanist in charge of the Bath Garden, gained the premium for the best specimen produced in the county of Surrey. The particulars are given by Lunan, vol. ii., pp. 75–76. The fibre was cleaned by being passed through a "cramp" fixed in the ground, and hung up to dry as soon as possible. It was pointed out that "the goodness of the fibre depends upon completely evaporating the sap, otherwise the least fermentation greatly impairs its strength; it cannot therefore be too thoroughly dried before it is packed for use or exportation." A nine-thread rope, 1 inch diameter, of plantain fibre made at the Dockyard, Port Royal, broke with a weight of 728 pounds; while a similar rope, known as "the King's nine-thread inch rope," broke by a weight of 714 pounds.

The most valuable *Musa* fibre is undoubtedly that yielded by *Musa textilis*, known in commerce as Manila hemp. There are about 12 different varieties of plants under cultivation all differing in habit and in quality of the fibre yielded by them. They thrive best in fresh clearings of jungle on low hills, and under shade of trees left standing at distances of about 60 feet. They do not do so well in open plains, and in swampy lands not at all. Manila hemp takes the chief place as a material for making white ropes for rigging and other purposes, and old ropes made of Manila hemp make excellent paper material. The magnitude of the industry connected with the Abaca or Manila hemp plant may be gathered from the fact that about 50,000 tons of fibre are annually exported from the Philippine Islands, of the value of about three millions sterling. This subject is more fully discussed in *Kew Bulletin*, 1887, April, pp. 1–3. The fruit of the Abaca is green and hard and unfit for food.

It is important to bear in mind that the Manila hemp plant is exclusively produced in the south-eastern part of the Philippines. All attempts to successfully cultivate it in the western and northern parts have hitherto proved abortive. The plants grew barely 2 feet high, and the produce never covered the outlay. The cause of these failures in the Philippines (as possibly in other countries where experiments have been made) is attributed to the dry season which continues for several months, while in the eastern provinces there are copious rains all the year round. Evidently the plant will only thrive under the latter condition, and it would be useless to attempt to grow it in countries



Musa textilis, **Née.**

1. Pistillate flower. 2. Staminate flower. 3. Fruit. 4. Section of fruit showing seeds.

where the rainfall is not large and well distributed all through the year.

There is a very complete set of specimens illustrating the Manila hemp industry in the Kew Museum. Various qualities of the raw fibre are shown from the Chatham Dockyard. In 1864 good fibre was stated to be worth 46*l*. per ton. A sample of "Quilot," one of the two specially selected qualities of Manila hemps, was received in 1890 from Messrs. Ide and Christie. It sells usually about 20*l*. per ton higher than ordinary Manila hemp. A sample of Manila hemp prepared at British Guiana in 1892 was valued at the time at 29*l*. per ton. A "two-inch" Manila rope from the Chatham Dockyard is shown side by side with similar ropes made at Calcutta and Madras. The Chatham rope had a breaking strain of 3,549 pounds (avoir.). The manufactured articles from Manila hemp consist of mats, cords, hats, plaited work, lace handkerchiefs of the finest texture, and various qualities of paper. The best qualities of stout packing and other similar papers in the United States are made from old Manila ropes. One of the latest applications of Manila hemp is the manufacture of lace and materials for ladies' hats and bonnets. The seat of the industry is at present at Wohlen in Switzerland. The lace for millinery purposes is made from pure Manila (Lupiz) hemp. It is used plain and dyed. The fancy hats and bonnets are woven from similar fibre stiffened and made into various patterns. Some of the hats are made of Manila hemp with a border woven from Sisal hemp. Hats are also made from a straw prepared from several strands of Manila hemp arranged side by side, immersed in gum and pressed. This straw is smooth, polished, and very pliable, exactly resembling the finest wheat straw.

The stems of many of the fruit-yielding bananas and plantains also yield fibre but not of so good a quality. Such fibre has long been used by the natives of India for cordage purposes, for mats, and to a smaller extent for making coarse paper. Dr. Royle devoted a considerable amount of attention to the subject. His conclusion, after numerous experiments, was as follows: "It is evident that plantain fibre possesses sufficient tenacity to be applicable to many at least of the ordinary purposes of cordage. The outer fibres may also be converted into a useful kind of coarse canvas as has been done by Dr. Hunter; and the more delicate inner fibres most probably into finer fabrics as is the case with those of *M. textilis* when equal care has been taken in the preparation and separation of the fibres, and there is some experience in weaving them."

In Jamaica a series of experiments, undertaken by Mr. Morris in 1884, showed that plantain fibre (*Musa sapientum* var. *paradisiaca*) was whiter and finer than ordinary banana fibre and that it approached more nearly to the fine glossy character of Manila hemp. A banana stem weighing 108 pounds yielded 25 ounces of cleaned fibre, or at the rate of 1·44 per cent. of the gross weight. A plantain stem weighing 25 pounds yielded 7¼ ounces of cleaned fibre. This was at the rate of 1·81 per cent. on the gross weight. A sample of fibre prepared from a red banana at Trinidad in 1886 was valued in London at 24*l*. to 25*l*. per ton. Usually, however, banana fibres are not worth more than 12*l*. to 15*l*. per ton. They would only fetch even these prices when there is a high demand for "white-hemp fibres" and there happens to be a short supply of Manila and Sisal hemps. (*Kew Bulletin*, 1887, April, pp. 5–8, with wood cut).

In the catalogue of contributions from British Guiana to the Paris Exhibition of 1867 the following remarks are made in regard to the prospects of a plantain-fibre industry in that Colony. The figures supplied are very valuable:—

"The fibre of thousands of acres of plantains is lost annually in this Colony from the want of a simple and inexpensive machine for separating it. The tree must always be cut down to obtain the fruit, and the stem containing the fibre is allowed to rot on the ground. Could an efficient and cheap machine be invented, the fibre would be almost entirely profit to the planter. The banana yields less fibre than the plantain tree, and its fibre is generally tinted.

"Various attempts have been recently made to construct machinery for manufacturing the plantain fibre. Subsequently to the Exhibition at Paris, in 1855, strenuous efforts were made to establish the production of fibre in this Colony as an article of export, and the Messrs. Watson had fibre-making machinery put up and tried on their estate, ***Haagsbosch***, but it was not found well adapted for the purpose, the stems in their natural state being so much more bulky than was allowed for in constructing the machines.

"Mr. A. D. Van Der Gon Netscher, when proprietor of plantation *Klein Pouderoyen*, on the west bank of the River Demerara, in 1855, furnished the following interesting particulars relative to fibre from the plantain:—The experience of 10 years on a cultivation of from 400 to 480 acres in plantains has shown that—1. On every acre from 700 to 800 stems are cut per annum, either for the fruit, or in consequence of having been blown down by high winds, or from disease or other reasons. 2. The planting of the suckers at distances of 8 feet apart has never been tried; but I am of opinion that if so planted and cut down every eight months for the stem alone, an acre would give from 1,400 to 1,500 good stems every cutting, or about 4,500 in two years. 3. On plantation *Klein Pouderoyen*, after repeated trials, the plantain stem on an average has been found to give 2½ lbs. clean, and 1½ lb. discoloured and broken fibre, the latter only fit for coarse paper. This result, however, has been obtained by very imperfect machinery. 4. The average weight of the plantain stem is 80 lbs. 5. The stems can be transported from the field to the buildings for one dollar per hundred."

Owing to the increasing cultivation of bananas in the West Indies, and the fact that when once the stems have borne fruit they are cut down and allowed simply to rot on the ground, some plan might be devised for turning the fibre to account. There are at least 50,000,000 banana stems cut down every year in the West Indies, and at present little or no use is made of the fibre. It is evidently not sufficiently good to compete with first-class rope fibres, but it might possibly be used for making coarse paper, as a packing material, or in the manufacture of *papier mache*. Its chief competitors in some of these directions would be Esparto, and the wood pulp prepared on so large a scale from poplar and other trees in Norway and Sweden. This wood pulp is delivered in this country at a cost not exceeding 2*l*. 10*s*. to 3*l*. 10*s*. per ton, and it is now very largely used by paper-makers.

Banana fibres from *Musa sapientum* are shown in the Kew Museum from the Andaman Islands, Jamaica, Mauritius, Ceylon, British Guiana, Madras, Australia. The Jamaica samples cleaned by the late Nathaniel Wilson are of excellent quality. A sample from British Guiana was valued in 1892 at 25*l*. per ton, but usually the price is much lower, and when other fibres such as Manila and Sisal hemps are low, banana fibre is practically unsaleable.

The facility possessed by banana fibre for taking up colour is shown in a specimen from Mr. Dickson. Paper prepared from banana fibre and rags is shown from the late Mr. T. Routledge. Also various papers made from banana fibre in India. From Mr. F. S. Reisenberger, in 1886, were received: 1, Half stuff from banana fibre; 2, paper from pure Jamaica banana fibre; 3, paper from equal parts of banana fibre and rags; and 4, paper from banana fibre loaded with China clay. There is also a portion of a leaf, gluten and prepared paper stock from the *pisang utang* from Sarawak, contributed by the late Mr. T. Routledge in 1875.

Fibre extracted from the Abyssinian banana (*Musa Ensete*) at Jamaica by Mr. Morris was yielded at the rate of 1·16 per cent. of the gross weight. The fibre was somewhat weak and dull-looking; it had none of the lustre of the best plantain fibre, and it was valued in London at 12*l.* to 14*l.* per ton.

Musa Basjoo is said to be grown in Southern Japan for the sake of its fibre. It is known amongst Europeans as the "Japanese plantain." The fibre is woven into cloth of an exceedingly durable character. Specimens are in the Kew Museum from Mr. J. H. Veitch, 1894.

Mr. Ridley (*Trans. Linn. Soc.* iii., p. 385), speaking of a new species described by him (*M. malaccensis*) from the eastern coast of the Malay Peninsula in 1893, adds:—

"An attempt has been made to utilise the fibre, but it is apparently not so good as that of *M. textilis;* still as it is not only very abundant throughout the centre of the Peninsula, but also springs up like a weed in many places where old jungle is felled and forms an impenetrable thicket, it will probably be found to be well worth extracting the fibre." A sample of this fibre, as already noted, is in the Kew Museum.

A very interesting series of articles prepared from the fibres of the stem of the banana was forwarded recently to Kew from the Solomon Islands by the Rev. R. B. Comins. The fibre itself is shown in a prepared state, some of it white and some black, ready for weaving. There is a native loom of a very primitive construction, apparently similar to the one used in West Africa for weaving native "pagns" cloths (*Kew Bulletin*, 1894, 191). It is capable, however, with dexterous manipulation of turning out cloth of a close texture and a very durable character. Two garments are shown made from banana cloth ornamented with small tufts of leaves of a *Pandanus*. There are also shown a decorated bag for holding betel and a sleeping mat of full size. On one of the garments there is woven a tasteful pattern by means of the dark-coloured threads. These garments are singularly well made, and they are, next to the Abaca cloth (from *Musa textilis* in the Philippines), the best fabrics in the Museum from bananas and plantains.

A fibre of a coarse character but evidently very strong, marked "Sime firigo," said to be derived from a species of *Musa*, was received from the Government of Queensland in 1890. It was obtained from the Kiwai Fly River, New Guinea.

Lace work ornaments worked with banana thread are in the Kew Museum from Jamaica sent in 1855.

BANANA WINE.

The preparation of a palatable drink sometimes called "wine" and sometimes "beer" or "cider" from bananas appears to have existed from remote times. The practice is known in Central Africa, in the West Indies, and in the islands of Polynesia. The remark that is usually made on the subject is the following:—

"The fermented juice of the banana is made at Cayenne and the Antilles into a palatable wine called "Vino di banana." A similar liquor is prepared in the Congo region, where it has the reputation of being a preventative of malaria."

One of the earliest accounts of the preparation of banana or plantain wine is given by Ligon in his *History of Barbados* (1657), p. 32:—

"But the drinke of the plantine is farre beyond all these; gathering them full ripe and in the height of their sweetnesse we pill off the skin and mash them in water well boyl'd and after we have let them stay there a night, we straine it and bottle it up, and in a week drink it; and it is very strong and pleasant drinke, but it is to be drunk sparingly for it is much stronger than Sack, and is apt to mount up into the head."

A few years later Dampier (*Voyages*, I., p. 316) gives a somewhat similar account of banana wine in Jamaica:—

"When they make drink with them they take 10 or 12 ripe plantains and mash them well in a trough; then they put two gallons of water among them; and this in two hours time will ferment and froth like wort. In four hours it is fit to drink; and then they bottle it, and drink it as they have occasion; but this will not keep above 24 or 30 hours. Those, therefore, that use this drink, brew it in this manner every morning. When I first went to Jamaica I could relish no other drink they had there. It drinks brisk and cool, and is very pleasant."

One sort of plantain is mentioned by Speke as yielding in Central Africa "a wine resembling hock in flavour."

On the other hand Schweinfurth found that "any fermented drink made from plantain to be almost unknown among the Monbuttos."

Mr. H. H. Johnson, C.B., in the neighbourhood of Kilima-njaro, speaks of Mandara's soldiers during an engagement quenching their thirst "with liberal draughts of banana beer which the women were constantly brewing."

Mr. Stanley (*Darkest Africa*, ii., p. 239) remarks that at Awamba:—

"Two large troughs—equal in size to small canoes—were stationed in the village, in which the natives pressed the ripe fruit and manufactured their wine."

Finally Dr. Parke in his *Personal Experiences*, p. 332, adds:—

"Nelson treated us to some *pombé* (banana wine) to-day; it was really very good, although made from bananas which were not at all ripe. This beverage is prepared by cutting two or three bunches of ripe bananas into pieces of half an inch in length, adding two gallons of water, and leaving it to stand. On the third day it is really a delicious drink. At first it has a sweet tart taste, which after four or five days becomes very acid. In a day or two more it changes to a fluid having qualities very like those of vinegar; quite as sour in taste and smell. If boiled down on the third day it makes a good syrup."

In Polynesia the banana drink made there is apparently not fermented but consists of fresh pulp made with bananas diluted with the milk of the cocoa-nut or water.

Loudon adds: "a drink like the best southern cider is made from the banana."

A proposal was made a short time ago to import bananas in pulp to Europe for the purpose of making wine from it.

TRADE.

Fresh Bananas in the United States.—The following information, issued in 1889 by a large dealer in bananas at New York, is reproduced from the *Agricultural Record* of Trinidad, i., pp. 47, 48:—

"Regarding bananas, good, large fruit and large bunches will always bring good prices in this market. Small bunches and small fruit never pay the shipper. March, April, May, June, and July, are the best months to ship bananas here. Extra fine large bunches in those months will bring $2 to $2 25c. per bunch and ready sale, when small bunches will not sell for over 60 c. to 75 c. per bunch and a drug in the market at even those low prices.

"Bananas are brought to New York by the thousands of bunches very successfully, and the passage by steamer is from eight to nine days and oft times 10 days. Our market would take one million bunches of bananas a month at $2 to $2 25c. per bunch (extra fine fruit) in the months mentioned above, and the banana trade is as yet only in its infancy. The demand is increasing each year.

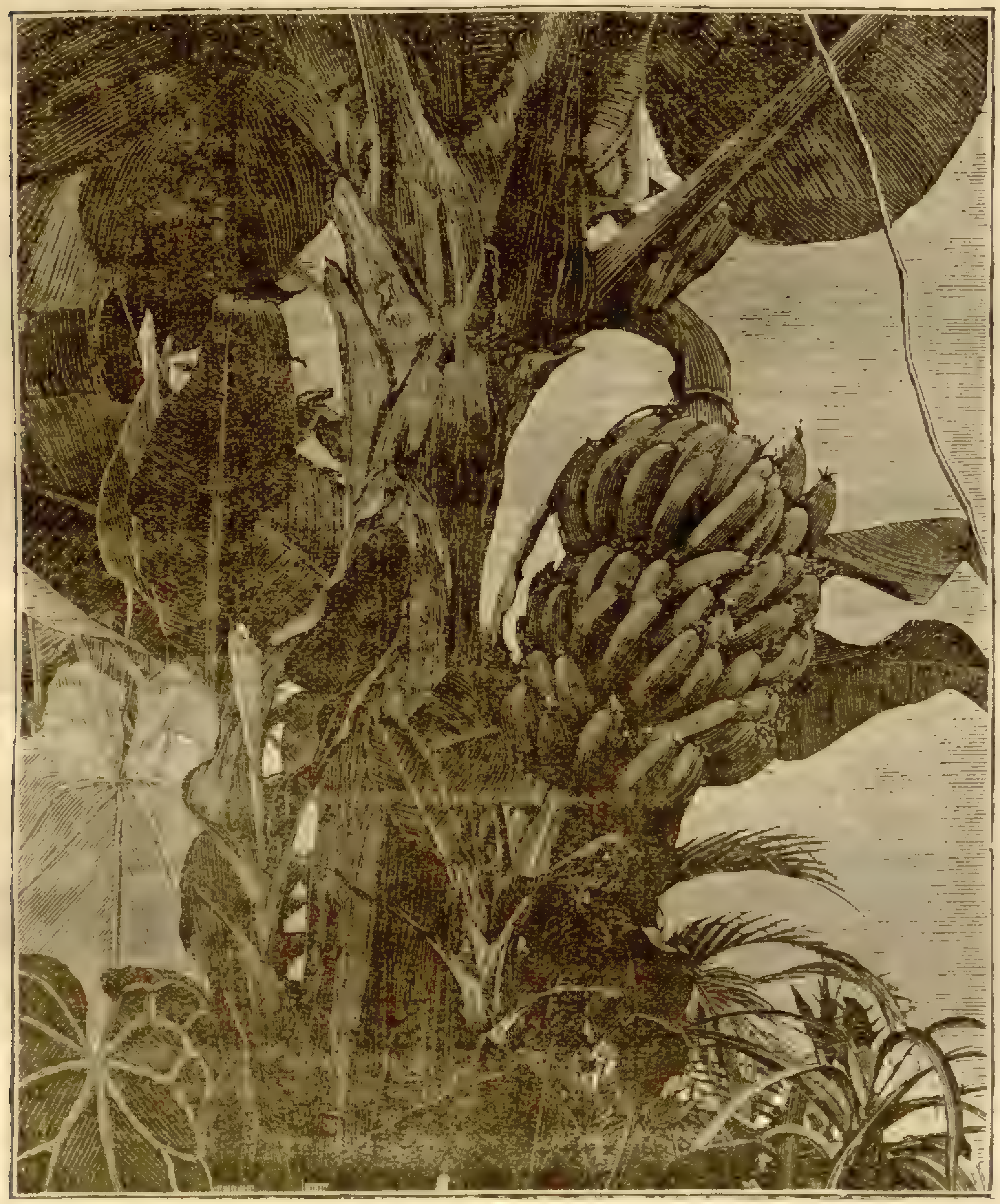
"I imported 20 years ago 4,000 bunches bananas from Baracoa, it took 10 days to sell them. Ten years ago I imported a cargo of 10,000 bunches on the S.S. "Cleopatra," from Jamaica; everybody said I was crazy; it took four days to sell them. This year I have seen 14 steamers discharging cargoes in New York in one week, ranging from 10,000 to 16,000 bunches bananas each. The cargoes were sold out in four to five hours."

The latest information in regard to the trade in fresh bananas at New York is contained in the following note which appeared in *Garden and Forest*, May 9, 1894, p. 190:—

"The demand for bananas is shown by the quick sale of 130,000 bunches in this city alone last week, at a wholesale price as high as $1 65c. a bunch. The scarcity and high price of domestic and all other foreign fruits, excepting pineapples, help the sale of bananas at this season, and large orders are received here from the interior and from Canada."

Fresh Bananas in England.—Fresh bananas are regularly shipped to this country and the Continent from Madeira and the Canary Islands. The quantity received is not large. This may be accounted for by the fact that the fruit is not always of good quality, and consists for the most part of the produce of the dwarf banana (*Musa Cavendishii*). When well grown and allowed to get fully ripe this is, however, an excellent fruit. As seen in this country it is evidently gathered before it is fully grown, the pulp is dry and mealy, and there is little or no flavour. A few bunches of the best Jamaica and Fig bananas are occasionally received in this country, but on the whole the English have not shown a disposition to use bananas as a dessert fruit on anything like the scale seen in the temperate parts of the New World.

According to the *Gardeners' Chronicle*, 1886 [1], p. 498, "The exportation of bananas from Grand Canary and Teneriffe is reported to be considerably on the increase, and it is expected that it will soon become one of the principal exports, as direct communication between Grand Canary and London is established. During 1885 from 40,000 to 50,000 bunches of this fruit were shipped to Europe, averaging 3*s.* per bunch, Grand Canary alone contributing between 25,000 and 30,000 clusters."



Musa Cavendishii, Lamb.
(From the *Garden*, 1893, p. 496.)

The Canary banana, as it is called in Covent Garden, arrives in this country with each bunch packed separately in narrow tall baskets made from the split stems of the common reed *Arundo Donax*, specially grown for this and other purposes in moist places in the islands. The bunch of fruit stands on end in the basket, and is carefully and compactly packed with dry banana leaves to prevent injury. The base of the fruit stalk or peduncle usually projects beyond the sacking covering the mouth of the basket, and it affords a convenient handle for lifting and moving the package in transit.

Bananas usually sell in England during about eight to nine months in the year. They are not sought for during the months of June, July, and

August, as fresh fruit, especially strawberries, are then coming into the market. Recently Canary bananas fetched on an average 8*s*. per bunch. Some extra large bunches fetched as much as 15*s*., "and, in very exceptional cases, as much as 21*s*. to 23*s*. has been realised per bunch." One dealer in foreign fruit at Covent Garden has storage room for 2,000 to 3,000 bunches, and sales take place three times a week.

The returns for bananas, as distinct from other fresh fruit, are not given separately in the Customs' returns, hence it is impossible to form an accurate idea of the total imports into the United Kingdom.

The following information respecting fruit-growing in the West Indies and on the probability of shipping fresh fruit to this country is taken from a paper read before the Royal Colonial Institute by Mr. Morris on "Fruit as a Factor in Colonial Commerce," February 8, 1887 :—

"A very interesting attempt was made last year to import fresh tropical fruit from British Guiana by Messrs. Scrutton & Sons, who had one of their steamers fitted with a cool chamber specially for the purpose. Bananas and many delicate fruits were received from the West Indies during the course of the Exhibition in excellent condition.

"The fruit trade in Jamaica is the means of circulating nearly 250,000*l*. annually amongst all classes of the community, and this large sum is immediately available, without the vexatious delays formerly experienced in establishing other and more permanent industries. Bananas, for instance, come into bearing, at the latest, in about 15 or 18 months from the time of planting, and as the return is usually from 10*l*. to 20*l*. per acre, the planter is able, with a comparatively small capital, to establish his land in cocoa, coffee, nutmegs, limes, oranges, and cocoa-nuts, which, when the bananas are exhausted, will remain a permanent source of revenue. It is on this account that I look upon the fruit trade of the West Indian Islands, as indeed of many other small industries, as calculated in the aggregate to build up, little by little, an improved condition for the people of these islands."

Export of Fresh Plantains.—The chief trade with the United States and Canada is in bananas. So far, fresh plantains have been imported only to a small extent. Plantains have, however, been grown and exported to the Southern United States from British Honduras, Guatemala and the Mosquito Coast, and they are much appreciated as an article of food. They can be packed loosely instead of in bunches as in the case of bananas, and the money value on the cultivation is much larger than on bananas. For instance, as shown by Mr. Brigham, the return on plantains in Guatemala is at the rate of 144 dollars per acre, while the return on bananas is 106 dollars. Plantains to the value of 12,191 dollars were exported from British Honduras in 1892. The present Governor of British Honduras, Sir Alfred Moloney, K.C.M.G., evidently looks upon the plantain as likely to be in much greater demand than at present in the United States, if only to supply an acceptable food to the negroes in the South. He says "the plantain is a staple food over a large section of negro land in West Africa. The descendants of its interesting people to the north of the Gulf of Mexico represent a consuming power of nearly nine million people. . . . Our shipment to New Orleans rose from 50,000 plantains in 1879 to 1,580,200 in 1891."

The exports from Jamaica, Cuba, and other islands in the Carribean Sea are almost entirely bananas. Plantains are regarded locally as so much more valuable for food purposes than bananas that they are comparatively scarce. There is no doubt they could be more largely grown if a demand arose for them. But the present situation is all in favour of exporting bananas only, and in keeping plantains as a staple food for the coloured population. It is quite possible that in a few years there will be a change. People in temperate countries who know little or nothing of the merits of the plantain are apt to regard it merely as an inferior banana. This is far from a due appreciation of its merits. In a cooked state, whether ripe or unripe, it is a wholesome and nutritious vegetable. It certainly will become in larger demand in the United States and Canada during the winter months; and it is possible also it may come into use in Europe if once it had trial under suitable circumstances. The flavour of an unripe plantain roasted or boiled resembles that of a chestnut, but it is not then sweet; when fully ripe it has the consistence of a pear with a sweet acidulous taste. It may then be eaten roasted or fried in fat like apple fritters. An important product of the plantain is plantain-meal. This is more fully dealt with later.

Guatemala.—The circumstances attending the cultivation and shipment of bananas and plantains to New Orleans and the Southern United States from Central America are very graphically described by Mr. William T. Brigham (*Guatemala*, pp. 351–354). This information applies also for the most part to the neighbouring countries of British Honduras and the Mosquito Coast. The comparison drawn by Mr. Brigham between the relative productiveness and value as between bananas and plantains is specially striking:—

"No export from Guatemala has increased more rapidly in value. The permanent establishment of lines of steamers between New Orleans and Livingstone, and the bounty offered by the Government, stimulated the planting of many small *fincas* along the shores and on the river-banks. Under contract with the steamship companies, the producer sells his bananas at 50 cents a bunch (of not less than eight hands) during five months of the year, and for 37½ cents the rest of the year. The cost of production may be placed at 12½ cents per bunch. All these prices are in United States silver currency. Plantains are sold at 25 cents a bunch of 25, sometimes commanding $1 25c. per 100. The profits of this business go, as usual, not to the producer, but to the middleman or the steamer companies. For example, a man raises 100 bunches of good fruit; the cost to him is $12 50c. delivered on board the steamer. He is paid in the best season $50 in silver, for which he can get $40 in American gold. The steamer people, after a voyage of four days, during which all their expenses are paid by the passenger list and the Government mail subsidies, sell the bananas on the wharf in New Orleans for $125 in gold or its equivalent, clearing $85; while the planter, for a year's labour put into the bananas, gets $30. I have put the price paid the planter at the highest, and the sales in New Orleans at the lowest. The loss is insignificant at these figures, and it is not uncommon for the profits of a single round trip of two weeks to exceed $40,000. Half this shared with the planter would make him rich.

"If the planting of bananas is to profit the grower he must raise enough, say 20,000 bunches a month, to freight his own steamer, and be independent of the present monopolies of the Italian fruiterers. The extent of this business is seen in the fact that from Livingstone in 1883 were exported 29,699 bunches, and in 1884, 54,633, or nearly double the amount.

"Of all the varieties of the banana (and I have myself seen at least 200, including the seeding banana of Chittagong) only two or three are raised for exportation in Guatemala, and these are by no means the best; but as the steamer people will give no more for a choice variety there is no inducement to improve the stock. Both yellow and red varieties are grown, and the former sometimes have 250 bananas on a bunch, weighing unripe, 90 pounds. The plantain is yellow when ripe (I have never seen a red variety), and is much larger and more curved than a banana, while the bunches are looser and much smaller, seldom numbering more than 35 fruits. Some plantains attain a length of 15 inches, and some are quite palatable uncooked, but the usual way to eat them is either baked or fried. Few of our Northerners appreciate the wonderful nutritive qualities of the plantain, which in this respect surpasses the banana, and it may be authoritatively stated that 1,607 square feet of rich land will produce 4,000 pounds of nutritive substance from plantains, which will support 50 persons, while the same land planted with wheat will support but two.

"The comparative cost and profit of cultivating bananas and plantains may be thus stated:—

Cost.		Profit.	
		Bananas.	Plantains.
	$		
Cost of one acre of land - -	1.00	300 bunches of bananas at 50 cents. less cost.	15,000 fruits of plantains at $1·25 per 100, less cost.
Clearing and planting - -	20.00		
Purchase of 430 stools - -	2.50		
Care of plantation per acre to first crop - - -	10.00		
Gathering and shipping crop -	10.00		
Total - - -	$43.50	$106.50	$144.00

"The second year the increase would be in favour of the plantain, and the product has reached more than 35,000 per acre. Of the fibre, no account has been taken, although this bids fair to become an important by-product. The plantain contains more fibre than the banana; the inner portion in both stems being much finer. At present the possible four pounds of fibre in each stem is wasted; and as the stems should be cut to the ground after the fruit is gathered, these large fibrous trunks are much in the way of cultivation. It will be remembered that the Manila hemp is the product of a species of banana (*Musa textilis*).

"Usually bananas or plantains are planted in a *cafétal* or in a cacao or orange orchard, to shade the young plants, and after three or four years are removed as the more permanent trees attain their growth."

Preserved Ripe Bananas.

For some years bananas have been preserved on a small scale in Jamaica, and it is hoped by this means to make use of small bunches of fruit not large enough to be shipped in a fresh state. Small bunches are, as a rule, unsaleable, although the individual fruits may be as fine, if not finer, than in the large bunches. It has been already shown that while 2 to 3 dollars will be paid in New York for large bunches the small bunches will not sell for over 60 or 70 cents, and, as a broker has graphically remarked, "be a drug in the market even at these low prices."

If a good opening were established for well-preserved bananas, a very attractive and palatable food, capable of being kept for some time, would be available to the population of temperate climates. Ripe, or nearly ripe, bananas have sufficient sugar in them to enable them to be dried like figs. They cannot always be dried in the sun. The process is too tedious and the fruit often assumes a dark colour with a taste and smell suggesting acetic fermentation.

In Western India at Agási, north of Bassein, Nairne says, "They have a way of drying bananas, which if done scientifically and for export might probably make the fruit in that form as popular in England as dried figs."

A sample of preserved bananas or plantains prepared at Kurunegala, Ceylon, by Mr. Morris, the Assistant Government Agent in 1840, was presented in that year by Dr. Wallich to the Agri.-Hort. Society of India (*Trans.* VIII., pp. 58–59). The kind of plantain used was that known in Ceylon as "Suandelle." Dr. Wallich stated, "The plantains appear to me to be little inferior to figs, and I should think them as wholesome and nutritious." Attached to Dr. Wallich's letter (as published) is given an extract from Captain Colquhoun's paper read before the Society of Arts on specimens of dried plantains called *platano passado* from Mexico. "The object of Captain Colquhoun is to direct attention to the dried fruit of the plantain as an article of produce hitherto unknown in British Colonies and in European commerce which would probably obtain a considerable comsumption in England, and also be very acceptable as a useful and agreeable article of food on long sea voyages."

Dr. Shier, of Demerara, is quoted in the "Catalogue of the Paris Exhibition of 1867," in regard to preserved bananas as follows:—

"*Ripe plantains and bananas.*—It was supposed by the Society of Arts (*Trans.*, vol. L., pt. i.) that the dried yellow plantain [or banana] might come into competition with figs, and the sample exhibited at the great London Exhibition of 1851, which had been prepared in Mexico many years before, proved the great superiority of the *platano passado* over figs in keeping properties and in immunity from insect ravages. In Mexico, the simple exposure of perfectly ripe plantains or bananas to the sun's rays is sufficient to prepare them for the market in an exportable form, as may be seen by the 'Method of Drying the Plantain,' described by Mr. Percy W. Doyle in a communication to the Earl of Malmesbury, a copy of which was transmitted to this Colony on 2nd August 1852 by Sir John Pakington. But whether from the greater moisture of this climate, or a greater proportion of nitrogenous elements in our plantains and bananas, it is found in practice that simple solar exposure is not adequate for the preparation of this dried fruit. There are three modes, however, by which the object can be attained:—1st, by exposing the fully ripe fruit to an atmosphere of sulphurous acid gas, previous to the drying process being commenced; 2nd, by a hasty boil of the fully ripe fruit in water containing sulphate of lime (hard water); and 3rd, by a similar parboil in syrup.

"By either of these processes the albumen and caseine of the fruit become sufficiently coagulated, and the tendency to fermentation and decay is arrested till the proper dryness is obtained. There is some nicety required in knowing the best degree of ripeness of the fruit. It should be full and beginning to turn yellow before the plantain tree is cut down and the bunch gathered. The fruit then should be kept either on the stalk or separated in a close dry place, as recommended in the Mexican plan, till the yellow of the rind has become black at the ends, with large spots over the surface, till on some of those black spots '*blue mould*' has begun to appear, and swarms of small grey flies hover over the heap, attracted, no doubt, by the saccharine odour, and till the fruit yields to a slight pressure of the finger and is somewhat supple in the hand. At this time, if some of the rind be removed, portions of the opaque yellow surface will appear as if melting. There should be no delay then in parboiling, or the fruit will be lost. If, on the other hand, the drying process is commenced too soon, a portion of the starch is still unconverted, and the dried fruit will be hard and want sweetness. This condition is easily discovered after the drying is completed, by the absence of a due amount of *shrinkage* in the fruit. To dry the fruit in the sunshine a bamboo frame as used in Mexico, or a net, or any other contrivance by which the sun and air can play on them, is suitable. They must, however, be removed to shelter on the approach of rain or evening dews. In rainy weather the heat of an oven is requisite, but the oven should be left open at the mouth, else the fruit will be baked instead of dried, and the heat should be comfortably bearable by the hand, else the grape sugar will be caramelized, and the core of the fruit blackened and rendered bitterish. Tight close packing in drums under considerable pressure, as with figs, would no doubt contribute materially to the preservation of dried ripe plantains and bananas."

Since Dr. Shier's time a great advance has been made in drying fruit. What are called "American" fruit-drying machines have been rendered so effective that little difficulty is experienced in drying the most succulent fruits in a few hours, and at the same time preserving all their fresh flavour, and also in many cases even the colour. The fumes of sulphurous acid, in no way injurious to the subsequent value of the preserved fruit for food purposes, are used to render some fruits like sliced apples of an attractive colour, and there is no doubt, although it does not appear to have been tried, a similar treatment would be of advantage if applied to the bananas. A dark colour would naturally give dried bananas an unattractive appearance, and prevent their extended use. In fruit-drying machines, properly worked, the danger can easily be obviated by keeping the temperature well below that necessary for the formation of caramel, and by the previous aid of sulphurous fumes the fruit might be produced of a pale buff colour, similar to that of figs.

It may be added that the comparative loss of weight by evaporation has been observed between apples and bananas, with the result that while apples yield only 12 per cent. of the original weight, bananas, with the skins removed, will give within a fraction of 25 per cent. of thoroughly desiccated fruit. Professor Church, with fruit grown at Kew, obtained 31·7 per cent. of dry matter from ripe bananas.

In 1881, when samples of dried ripe bananas were forwarded to this country by the late Mr. W. B. Espeut, F.L.S., of Jamaica, Messrs. Fortnum, Mason, & Co., stated, "we are afraid they are not suited to the

English taste. The dried banana is no novelty to us, as for several years past West India merchants have endeavoured to introduce it to the London market, but with doubtful success, as in no instance have we heard of their being imported by the same firm a second time." Messrs. Mart & Co., of Oxford Street, gave a somewhat similar opinion: "the samples are very good, but we do not think any large or even moderate trade would be done in them . . . about 25 years since some preserved spiced bananas, in sealed tins, were sent to us from Jamaica, and again some dried ones were sent from Ratatonga; these were quite black. On another occasion some arrived in London, wrapped in Indian corn leaves; they were in neat parcels of about 1½ pounds weight each, but much darker than the present samples."

Again in 1888 a very attractive sample of preserved bananas was received at Kew from Mr. W. Fawcett, F.L.S., Director of the Botanical Department, Jamaica. In this sample the fruit was preserved whole, it was of good colour, and put up in a neat small box, exactly like the best qualities of figs. The report in this instance was, however, not very encouraging. In *Gall's Weekly News Letter* of August 9, 1890, the subject of exporting preserved bananas from Jamaica is revived. The new process of drying the surplus bananas, it says, "opens up a vista of future prosperity, and presents a pleasing picture of agricultural welfare before our eyes. Samples of dried bananas were submitted to the Royal Agricultural Society, and other samples have been sent to prominent fruit importers in England and Scotland, and the reports have been of an exceedingly satisfactory character."

One correspondent wrote:—"I submitted the sample to Mr. Jamieson, one of the largest fruit importers in Edinburgh. By a strange coincidence he had been shown a sample of the same article from Madeira on the previous day. The sample he thought a little better than yours, not being so highly dried, and retaining more of the real flavour of the fresh fruit. He is of opinion that if the drying process could be brought to greater perfection, and as much as possible of the fruity flavour preserved, they would take the place of every other dried fruit, and there would be a large demand for them. He says people are getting tired of figs, dates, &c., and would eagerly turn to bananas for a change."

In Venezuela the best banana for preserving is the *cambur morado* or red banana, because, says Diaz, "it is larger and it has a better flavour." In the dry climate of the lower hills the process can be successfully carried on by simple exposure to the sun. The bananas must be quite ripe, they are stripped of shell and fibre and placed on a cloth in the sun, being turned every two hours without crushing them like the plantain; at night they are gathered in and the next day put out again, and so on until they are perfectly preserved. "If they have five or six sunny days in succession they are good in that time."

It would appear that the United States and Canada are likely to afford as favourable a market for preserved bananas as for the fresh fruit. Most of the preserved bananas hitherto prepared in the West Indies have gone to these countries. As showing the result of an interesting experiment tried with preserved bananas in Trinidad the following account of fruit, shipped to Canada, is taken from the *Agricultural Record* of Trinidad, 1891, pp. 143–144.

Convict Depôt, Chaguanas,
Dear Sir, April 9, 1891.

Messrs. Gordon, Grant, & Co. have kindly given the result, in an account sale, of a trial shipment of preserved ripe bananas. I venture to think this experiment will prove to be of important interest to banana growers, especially to those who have the right kind for drying, namely, the Gros Michel, known also as the Jamaica or Martinique banana. Drying the bananas opens up a way of utilising the fruit that no other means offers. It overcomes the difficulty of bad roads, remote districts, and other drawbacks which the planter has to face in getting his bananas to market. It also does away with the risks of handling and of the sea voyage.

Dealing with the first item in the account, namely, 97 boxes, this number represents the result of drying six bunches, weighing on an average 52 lbs. per ripe bunch. A loss of one-third takes place in the peeling and drying process. The 97 boxes contained one pound of dried fruit each and sold for $19 40c. or 20c. per lb. box, or, after deducting freight charges, $15 47c., a fraction under 16c. per lb.

A bunch weighing 52 lbs., less one-third in drying, gave 17 lbs. of dried fruit and sold at 16c. per lb. This is at the rate of $2 72c. per bunch. A further charge of 53c. must be considered in producing the bunch. This would cover purchase of land, clearing woods, draining, planting, weeding, cutting, drying, fuel, boxes, and packing. I have not included cost of drier, as that would be but a fraction on each bunch dried. Now after deducting the above we have a clear profit for the grower of $2 19c. (about 8*s*.) for every bunch of fruit produced.

This fine price has, I think, rarely been equalled in Trinidad for bananas and should encourage growers of this fruit to enter fully into the matter and improve upon my experiment. Not to do so would be to confirm his Excellency the Governor's words in the opening speech at our late exhibition "that the want of interest in a fruit trade was suicidal."

I do not desire to set up as a teacher, but facts and figures speak for themselves. The account shown is not an approximate one, but the money has been received, and the Canadians are asking for more at the same price. An order is now on hand for 2 cwt. for London at 6*d*. per lb. in bulk, the consignee doing the retail packing and advertising. As the fruit is something new it is being sought after, and all that can be dried is being profitably disposed of. I may add that the fruit-drier does its work well, turning out the fruit in an uniform colour. Attention must be paid to this and also that fruit as nearly as possible of one size only be dried, as this facilitates packing. Small ones can be used for stock, &c.; 12 good-sized fruits weigh one pound.

Gros Michel bananas dry best and give the best result. Governor bananas take second place; the other varieties are not suitable. I state this from experiments with them all.

I trust in a measure the foregoing will aid to dispel the doubts and anxieties frequently expressed as to a profitable means of dealing with our fruit, especially bananas, for they are absolutely indispensable in growing young cocoa, for shade purposes. To those not well posted in the subsidiary industries and who are seeking information, that there is interest being taken in the matter is evident, for if only one line be mentioned upwards of 100,000 banana plants have been distributed in Trinidad and Tobago from the depôt during the past two years, and as many more can be had if required. The purchasers of these plants are principally large planters, and this shows that there is money in bananas.

I recommend with confidence to the purchasers of these plants and to others interested, the advantages of a dried fruit trade. I do so from the facts I have learnt in the experiments made in aid of the fruit trade.

C. W. Meaden.

Mr. C. W. Meaden adds that drying ripe bananas in the open air has proved a failure. This, however, has been remedied by the use of a hot air fruit-drier known as the "Etna Pneumatic Drier." The fruit in this "can be dried within 24 hours at a temperature from 130° to 160° F. A higher temperature than this is undesirable as the fruit hardens. The drying is done in the daytime and the fire put out at night. Any kind of fuel answers for firing, from patent fuel to cocoa-nut wood chips. The fruit should be as large as possible and quite ripe; the skin to be removed and the fruit lightly scraped. Whilst in the drier the fruit is to be turned twice or three times carefully to ensure even drying."

Preserved bananas from Fiji have recently been sold retail in London at 7*d.* per pound. To ensure a large demand for the fruit in a preserved state it must compete successfully with figs, dates, and raisins, both as regards quality and cheapness.

Preserved bananas are represented in the Kew Museum from Mr. Espeut, Jamaica, 1881, dried whole. Also from British Guiana, Col.-Ind. Exhibition, 1886. "Cannore figs" from Siam, shown at the Health Exhibition, 1884. "Dried bananas" from the Straits Settlements, 1886, neatly put up in a soft packing of dried banana leaves. A torpedo-shaped package tightly tied round with banana cord containing dried bananas received from Sir Ferd. von Mueller from Queensland.

Plantain Meal.

A good deal of interest has been taken lately in the production of plantain meal for food purposes in temperate countries. This in some measure is due to the frequent mention made of it in Mr. Stanley's work (*In Darkest Africa*) giving an account of the Emin Pacha Relief Expedition. But for the plantain, either in a fresh state or made into meal, this expedition would probably never have accomplished its task.

For instance near the Amiri Falls (Vol. I., p. 450) "the foragers returned, often in couples with an immense bunch of plantains between them . . The more provident, however, bore larger quantities of the fruit, peeled and sliced, ready for drying, thus avoiding the superfluous stalk and skin . . The fruit when dry could be converted into cakes or palatable plantain porridge or a morning's draught of plantain gruel. Many of the finest specimens were reserved to ripen to make a sweet pudding, or a sweet brew, or for sauce for the porridge."

When between the Albert Edward Nyanza and the Albert Nyanza (Vol. ii., pp. 239–240) :—"For the first time we discovered that the Awamba, whose territory we were now in, understood the art of drying bananas over wooden gratings, for the purpose of making flour. We had often wondered, during our life in the forest region, that the natives did not appear to have discovered what invaluable, nourishing, and easily digestible food they possessed in the plantain and banana. All banana lands—Cuba, Brazil, West Indies—seem to me to have been specially remiss on this point. If only the virtues of the flour were publicly known it is not to be doubted but it would be largely consumed in Europe. For infants, persons of delicate digestion, dyspeptics, and those suffering from temporary derangements of the stomach, the flour, properly prepared, would be of universal demand. During my two attacks of gastritis, a light gruel of this, mixed with milk, was the only matter that could be digested."

Dr. Parke, surgeon to the expedition, also speaks (*Personal Experiences in Equatorial Afrcia*, p. 322) of the use of banana or plantain flour :—

" We found a little porridge of scalded banana flour, which had been just freshly made; and a few leathern belts, which is the only native article of apparel. The discovery of this sample of porridge here struck me as very peculiar; the first place where we had seen bananas dried and pounded into flour was at Ugarrowwa's camp; even the Zanzibaris, and the other natives whom we have met on our line of progress, had not known this method of preparing bananas for food till they saw it used by us. So it is evident that the few natives with whom we had become intimate on our way had returned to their villages and told their neighbours what they had seen us do.

" Ever since we learned this method of preparing our bananas we have been able to diminish our risk of starvation very considerably. We can make enough flour in one day for several days' rations ; and the weight is so much less than that of the corresponding quantity of the green bananas, that men can carry a considerable number of days' rations with them, in addition to their other loads, whereas they could not manage more than a couple of days' supply of the green bananas. The banana flour is most nutritious and very sustaining."

It is generally recommended that to make the best banana meal the fruit should be in an unripe condition.

The changes that take place in the banana fruit during the successive stages of its growth and ripening are described by Dr. Warden in the *Dict. Econ. Prod. of India*, Vol. V., p. 301 :—

" The composition of the banana at different stages of maturity has been investigated by L. Ricciardi. The green fruit contains over 12 per cent. of starch, which disappears as the fruit ripens. It contains 6·53 of tannin and the ripe only ·34 per cent., so that as the fruit ripens this principle disappears, and this is also the case with the other organic acids which are present. The sugar in the fruit which ripens on the tree is almost entirely cane sugar, but in the fruit cut and ripened by exposure to air the invert-sugar reaches about 80 per cent. of the total, while the cane sugar is reduced to about 20 per cent., calculated upon the sugar present. Proteid substances (albuminoids) are present in the green fruit to 3·04 per cent., and in the ripe to 4·92 per cent. The green fruit yields 1·04, and the ripe ·95 per cent. of ash, which contains 23·18 per cent. of phosphoric anhydride, and 45·23 per cent. of potash."

The use of plantain-meal as an article of food is doubtless of great antiquity. It is frequently mentioned by old authors. Rumph records that in the Malay archipelago " man begins life with plantains " as the meal is used for making pap for new born infants.

In the *Dict. Econ. Prod. of India*, Vol. V., p. 300, the same point is more fully stated:—

"It is interesting to notice that the large crop of food produced by bananas and plantains may be preserved for an indefinite period either by drying the fruit or by preparing meal from it. Both of these processes, which have long been known and carried out in the West Indies and South America, are also carried on in India, though to a much smaller extent. Linschoten notices the practice as common in the sixteenth century, writing,—'these grow much in Cananor, in the coast of Malabar, and are by the Portingales called figges of Cananor; and by reason of the greater quantities thereof are dried, the shells being taken off, and so being dried are carried over all India to be sold.' When the nearly ripe fruit is cut into slices and dried in the sun a certain part of the sugar contained in the fruit crystallizes on the surface and acts as a preservative. The slices thus prepared, if made from the finer varieties, make an excellent dessert preserve, and if from the coarser may be used for cooking in the ordinary way. They keep well if carefully packed when dry, and ought to form a valuable antiscorbutic for long voyages. The fruit may also be similarly preserved whole by stripping off the skin and drying it in the sun. Plantain meal is prepared by stripping off the husk, slicing the core, drying it in the sun, and when thoroughly dry reducing it to a powder, and finally sifting. It is calculated that the fresh core will yield 40 per cent. of this meal, and that an acre of average quality will yield over a ton."

A good account of plantain meal and its value for food purposes was published by Professor Johnston in the *Transactions of the Highland Society*, No. 20. This was reproduced in the *Barbados Agricultural Reporter*, August 8th, 1848.

The inquiry was started by the receipt of a sample of plantain meal sent to Scotland from Surinam or Dutch Guiana. It is remarkable that after an interval of nearly 50 years the starting of a factory for the manufacture of plantain meal in the same Colony should once more bring the subject into notice.

Professor Johnston says: "Plantain meal is of a slightly brownish colour, and has an agreeable odour, which becomes more perceptible when warm water is poured upon it, and has a considerable resemblance to that of orris root.

"When mixed with cold water, it forms a feebly tenacious dough, more adhesive than that of oatmeal, but much less so than that of wheaten flour. When baked on a hot plate, this dough forms a cake which is agreeable to the sense of smell, and is by no means unpleasant to the taste. . . . . .

"When boiling water is poured over the meal it is changed into a transparent jelly, having an agreeable taste and smell. If it be boiled with water it forms a thick gelatinous mass, very much like boiled sago in colour, but possessing a peculiar pleasant odour."

In the plantain "while green, the heart is white and insipid; the starch predominates, and it scarcely contains any sugar. In this state it is roasted in the ashes, and at table takes the place of bread, potatoes, maize, and other farinaceous food. In South America they are dried entire in ovens, and become hard, brittle, and translucid like horn. Under the name of 'fifi' they are, in this state, taken as travelling stores in sea voyages and long journeys by land."

The starch of the arrow-root, cassava, and of the ordinary potato is easily extracted, but, according to Dr. Shier, the starch from the plantain (in the unripe state) cannot be extracted in a perfectly white condition, in consequence of being associated with a colouring matter from which it is almost impossible to separate it. This colouring matter resists the action of the most powerful bleaching re-agents.

In 1890 analyses of the unripe banana and plantain fruit were published by Messrs. Harrison and Jenman (*Report on Agriculture*, British Guiana, p. 59) :—

"Composition of a Sample of Bananas (unripe).

—	Dried.	Fresh.
Water	5·75	75·11
Oil or fat	·69	·18
Sucrose	None.	—
Glucose	1·75	·29
Starch	42·11	11·11
*Albuminoids	5·13	1·35
Gums, &c.	1·88	·36
Digestible fibre	36·87	10·07
Woody fibre	2·52	·66
Ash (mineral matter)	3·30	·87
	100·00	100·00

* Containing nitrogen, dried ·84, fresh ·22.

"Though the food elements in the banana vary from those of the plantain, the sum total of them is much about the same. The plantain is decidedly richer in starch and glucose, while the banana excels in albuminoids and digestible fibre. The advantage in value is with the plantain."

"The following analyses of the common plantain, fresh and dried respectively, are closely representative of the character of all varieties. Plantains are essentially a starchy food, deficient in albuminoids and fats :—

"Composition of Sample of Common Plantains.

"Fleshy matter or pulp, 64·5 per cent. ; skin, 35·5 per cent.

—	Fresh Pulp.	Flour from Dried Pulp.
Water	62·86	11·80
Fats	·44	1·05
*Albuminoids	1·58	3·75
Glucose	2·25	5·34
Starch	22·16	52·64
Tannin, gum, &c.	·50	1·20
Digestible fibre	9·01	21·37
Indigestible fibre	·40	·95
Ash (mineral matters)	·80	1·90
	100·00	100·00

* Containing nitrogen, fresh pulp ·25, flour from dried pulp ·60."

A valuable paper on the chemistry of the banana was published by the late M. B. Corenwinder in *Annales Agronomiques*, ii. (1876), pp. 429–445. His main results were obtained from a bunch of 107 fruits sent to him from Brazil in August 1875. The bunch was a month in transit to Lille. He found 34 per cent. of peel and 66 per cent. of pulp. His best fruits, while sound, gave 15·9 per cent of sucrose and 5·9 per cent of glucose. His worst gave 2·84 per cent. of sucrose and 11·84 per cent. of glucose.

Corenwinder gives the following complete analysis of the pulp (p. 436) :—

COMPOSITION of fresh BRAZILIAN BANANA (pulp only).

Water - - -	72·46
Sugar (sucrose) - - -	15·90
Sugar (glucose) - -	5·90
Cellulose - - -	·38
*Albuminoids - - -	2·13
Pectose - - -	1·25
Oil, &c. - - - -	·95
Ash - - -	1·03
	100·00

The composition of the ash (from the pulp) is given by Corenwinder. In the opinion of Professor Church, there is a possible mistake here in regard to the magnesium carbonate present.

MINERAL COMPOSITION of the ASH from the PULP of the BRAZILIAN BANANA.

Potassium sulphate - -	3.61
Potassium chloride - -	14·34
Magnesium phosphate -	2·24
Potassium phosphate -	27·12
Potassium carbonate - -	41·66
Magnesium carbonate -	6·54 ?
Calcium carbonate - -	1·17
Ferric oxide - -	0·36
Silica - - - -	2·96
	100·00

In the South Kensington Museum Handbook on "Food" (reprint of 1893, p. 135) Professor Church, F.R.S., gives an analysis of fresh-peeled bananas (apparently nearly, if not quite, ripe). This affords information on a point not already discussed. The bananas were those usually sold in shops in this country, and it is not improbable they were Canary bananas yielded by *Musa Cavendishii.*

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* Containing nitrogen ·34.

" Fresh-peeled bananas contain :—

	In 100 parts.	In 1 lb.	
		oz.	grains.
Water - - - -	73·9	11	361
Albuminoids, &c. - - - -	1·7	0	119
Sugar and pectose - - -	22·8	3	283
Fat - - - - - -	0·6	0	42
Cellulose - - - -	0·2	0	14
Mineral Matter - - - -	0·8	0	56

The nutrient-ratio is here 1 : 14 ; the nutrient-value is 24."

The "nutrient-ratio" amongst the nutrients of daily food is that between the albuminoids or "flesh-formers," and the carbohydrates plus the fat reckoned as starch, or "heat-givers." In the standard dietary adopted it is 1 : 4¾.

For the sake of making a rough comparison between various foods, it is a convenient plan to add together the per-centages of albuminoids, starch, dextrin, and sugar, and the starch equivalent of any fat present. The sum of these constituents is called the "nutrient-value ;" this value is that of 100 parts.

A further sample of ripe bananas (a variety of *M. sapientum*) grown in the Palm House at Kew was submitted to Professor Church in May last. The results of his analysis are as follows :—

" Water in pulp - - - - -	68·3 per cent.
Dry matter in ditto - - - - -	31·7 „
Albuminoids, calculated from total nitrogen in pulp.	1·515 „
True albuminoids in ditto by phenol method -	1·03 „

"The latter figures seem to show that one-third of the nitrogen in the just-ripe pulp exists in non-albuminoid forms."

The most recent analyses of meals are those lately made for Kew by Professor Church, of a sample received through Messrs. Lee, Crerar, & Co. from Jamaica, and called "banana" meal, although it is quite possible it may have been prepared from unripe plantains. The other samples were from Surinam. The latter were particularly stated to be derived from the fruit of the banana (*Musa sapientum*).

Professor Church's analyses of these samples, with explanatory notes, are given below :—

Professor A. H. Church, F.R.S., to Royal Gardens, Kew.

Shelsley, Kew Gardens,
February 16, 1893.

Dear Mr. Morris,

I have arranged in the table which follows, the results of my analyses of some of the banana meals which you handed to me for examination. The Jamaica sample is designated by the letter A.; the Surinam sample of the meal made from the interior of the fruit of *Musa sapientum* by the letter B.; and meal from the peels of the same fruit by C.

PER-CENTAGE COMPOSITION of BANANA MEALS.

——	A. Jamaica.	B. Surinam.	C. Surinam.
Water	15·5	14·3	13·1
Albuminoids (true)	2·5	2·3	3·3
Starch, sugar, gum, &c.	77·7	79·5	58·7
Oil	1·0	·7	5·5
Fibre	·7	·9	8·7
Ash	2·6	2·3	10·7
Nutrient ratio	1:32	1:35	1:22
Nutrient value	82	83	74

It is noticeable how widely the nutrient ratio (or proportion of albuminoids to starch plus the starch-equivalent of the oil) diverges in all these meals from the ratio of a perfect food, which should show the proportion of about one to five. In the analyses by Mr. L. E. Asser the above divergence seems less marked, for he has calculated the whole of the nitrogen present as if it existed in the albuminoid form. I find that this is far from being the case. In his Surinam sample 2 (B. above) 71 per cent. only of the nitrogen present is albuminoid; in his sample 5, made from the peels, 77 per cent. In other respects my results and his agree well.

I would further remark that sample A. (from Jamaica) was probably made from fruits still more unripe than those which were used in the preparation of B. and C. For in this meal no more than 56 per cent. of the total nitrogen exists in the albuminoid form, the remaining 44 per cent. being present in the less highly elaborated state of amides, &c., the food value of which is either *nil* or very slight.

In all the above samples starch is more abundant than sugar; the proportion of the latter increases as the fruit ripens.

The constituent set down as "oil" in the table of analyses is the ether-extract of the meals. In the case of C, the meal prepared from the peels, it consists partly of wax and colouring matter.

In the ash of the meal prepared from peels a notable quantity of manganese was found. Traces of copper occurred in all the samples.

Yours truly,
(Signed) A. H. CHURCH.

Samples of the unripe fruits of the plantain, dried whole without the peel and slightly scraped, are in the Kew Museum from British Guiana. There are also dried plantains in thin transverse slices from Bombay and British Guiana. Plantain and banana meals are shown from Madras of a dark colour; from Fiji of a light chocolate colour; from Jamaica both of a dark and light colour. The latter sent by Mr. Chitty is of excellent texture and quality. It has been in the Museum nearly 35 years.

BRITISH GUIANA.

The following interesting suggestions respecting the preparation of plantain meal are taken from a report prepared in 1847 by Dr. Shier on the Starch-producing Plants of British Guiana. They appeared in the "Catalogue of Contributions transmitted from British Guiana to the Paris Universal Exhibition of 1867," pp. xlviii–li. :—

"The plantain is sometimes so abundant and cheap that it might, if cut and dried in its green state, be exported with advantage. It is in this unripe state that it is so largely used by the peasantry of this Colony as an article of food. It has always been believed to be highly nutritive; but I have not found in any sample of the dried plantain which I have analysed a larger amount than ·81 per cent. of nitrogen, which corresponds with about 5½ per cent. of proteine compounds. When dried, and reduced to the state of meal, it cannot, like wheat flour be manufactured into maccaroni or vermicelli, or, at least, the maccaroni made from it falls to powder when put into hot water. Plantain meal is prepared by stripping off the husk of the plantain, slicing the core, and drying it in the sun. When thoroughly dry it is powdered and sifted. It is known among the Creoles of the Colony under the name of *conquintay*. It has a fragrant odour, acquired in drying, somewhat resembling fresh hay or tea. It is largely employed as the food of infants and invalids. In respect to nutritiveness, it deserves a preference over all the pure starches on account of the proteine compounds it contains. The plantain meal would probably be best and freshest were the sliced and dried plantain cores exported, leaving the grinding and sifting to be done in Europe. The flavour of the meal depends a good deal on the rapidity with which the slices are dried, hence the operation is only fitted for dry weather, unless, indeed, when there was occasion for it, recourse were had to a kiln or stove. Above all, the plantain must not be allowed to approach too closely to yellowness or ripeness, otherwise it becomes impossible to dry it. The colour of the meal is injured when steel knives are used in husking or slicing, but silver or nickel blades do not injure the colour. Full-sized and well-filled bunches give 60 per cent. of core to 40 of husk and top-stem; but in general it would be found that the core did not much exceed 50 per cent., and the fresh core will yield 40 per cent. of dry meal, so that from 20 to 25 per cent. of meal is obtained from the plantain, or 5 lbs. from an average bunch of 25 lbs., and an acre of plantain walk of average quality, producing during the year 450 such bunches, would yield a ton and 10 lbs. of meal. Even supposing the meal not to command over half the price of arrowroot, it would still form an excellent outlet for plantains whenever, from any cause, the price in the Colony sank unusually low."

UNITED STATES.

During the year 1892 it is stated that nearly 13 million bunches of ripe bananas were imported into the United States. Each bunch usually consists of 80 to 200 bananas, and weighs from 30 to 90 pounds. Bananas were received principally at New Orleans, New York, Philadelphia, and Boston, each of which imported not less than two million bunches. It is said that these enormous figures are likely to be exceeded in later years. The banana is grown for export chiefly at Jamaica, Cuba, Nicaragua, United States of Colombia, Honduras, and Costa Rica. The value of fruit exported from Jamaica in 1891 (chiefly to the United States) amounted to 531,726*l*.

"The great advantage," according to a New York correspondent, of the application of the desiccating process to bananas would be that it would enable us to turn to account a quantity of raw material which now goes to waste. There is practically no limit to the amount of bananas which we could get from the islands if we could use them. They are shipped green and ripen on the voyage. When they arrive here it is calculated that they will be fit for table use. But they are very perishable property. If they are not consumed within a week after their arrival vast quantities rot and are thrown away. Strings of banana waggons perambulate the city seeking purchasers at nominal prices, because if immediate sales cannot be effected the contents of the waggons will be a total loss.

"If we had a desiccating plant that could convert the fruit into dried fruit or flour we could largely increase our importations and turn out a product which would command a sale all over the coast and in the East."

The manufacture of banana meal in the United States would have a certain amount of protection from outside competition, for while there is no duty, or a small one, on the fresh fruit, there is a duty of 20 per cent. on banana meal as a manufactured product.

JAMAICA.

The enormous production of bananas in Jamaica has already been noticed. In this island bunches of a certain size only possess a marketable value. All others are practically useless except for consumption locally, and already the supply for this is greatly in excess of the demand. As Jamaica is at present the largest producer of bananas for export, it follows that the preparation of banana meal would have a wider scope in this island than probably anywhere else. A sample of what was called banana flour prepared in Jamaica was communicated to Kew in 1892. This was analysed by Professor Church, F.R.S., with the result already given.

Some years ago plantain meal—as distinct from banana meal—was in use at the Public Hospital in Kingston, and was considered a wholesome and nutritious food. It formed an excellent diet for patients suffering from diarrhœa, dysentery, and allied ailments. This is confirmed by experience in India. "Flour made out of green plantain dried in the sun is used in the form of *chappatis* (unleavened cakes) in certain parts of Tirhoot in cases of dyspepsia with troublesome flatulence and acidity. I have known," says a medical officer, "one case in which it agreed remarkably well whenever a diet of plain sago and water brought on a severe attack of colic. The *chappatis* are taken dry with a little salt." There is always present in plantain meal a certain small per-centage of tannin.

In a report on the Exhibits sent from Jamaica to the Chicago Exhibition, 1893, Colonel Ward, C.M.G., the Commissioner, makes the following remarks on the subject of banana meal and preserved bananas :—

"The banana meal engaged the careful attention of several of the leading grocers in Chicago and elsewhere. One large house in Chicago, Sprague, Warner, & Co., after testing samples of this meal was so pleased with the result that it offered to undertake to introduce it as a food for infants and invalids, provided the producers would guarantee to supply the necessary amount to advertise it extensively throughout the United States. Messrs. Sprague, Warner, & Co. estimated that a sum of not less than $25,000 would be necessary to launch this new product on the American market, and unless this sum were forthcoming, they did not see their way to dealing with it on the ground that no sales in any quantity could be expected. This proposal was in due course submitted to the exhibitors, whose meal had been experimented upon; but unfortunately those gentlemen were unable at the time to adopt the course proposed, and the matter is still in abeyance. I am strongly of opinion that with a judicious outlay of capital, and with a reasonable certainty that no sudden changes will be made in tariff regulations, there is a market open for banana meal in the United States.

"I have seen ripe bananas offered for sale in the streets of Chicago, at almost the same price as they are in Kingston, though of course the quality is distinctly inferior."

TRINIDAD.

The following account of the preparation of plantain meal at the convict farm, Trinidad, by Mr. C. W. Meaden is quoted in the Bulletin of the Botanical Department, Jamaica, xxvi., p. 5. The meal was prepared from a plantain known in Trinidad as the "Moko." This is usually grown as a shade for young cacao trees. It appears, otherwise, to have little value. Mr. Hart refers to it in his report for the year 1887, p. 18, as "the useless Moko or Jumbi plantain or Fig." It is somewhat remarkable that the meal prepared from this despised but very widely distributed plant should prove of so good a quality.

"No banana gives such an excellent meal as the 'Moko,' or so agreeable in flavour and taste. The preparation of the meal is as follows:—The green Moko was skinned, sliced thin, and dried in the fruit drier; then ground fine in an ordinary corn mill, and afterwards sifted through a muslin sieve; this latter removes any fibre, and leaves a delicate fine meal. The slices dry in two hours. A 15 lb. bunch will yield 3 lbs. of prepared meal, which at 6*d.* per pound is 1*s.* 6*d.* per bunch. Two women could prepare 56 lbs. of meal per day. The cost of production, packing, &c., has to be considered, but the price estimated to be obtained in this way for the fruit must be considered a satisfactory one; at least it is better than that now obtained, which may be said to be nil."

In a letter to the *Port of Spain Gazette*, dated 21st October 1892, Mr. Meaden gives the following further particulars:—

"It is proved by analysis that bananas contain 76 per cent. of starch, and it is certain that an article containing this quantity must have a profitable market value. Sliced bananas at a temperature of 130 per cent. dry in two hours and could be packed for shipment from the green bunch well within the day's work. A drying apparatus for this purpose can be most cheaply and effectually built by a local workman, and it would also be useful on the estate for all drying purposes."

DUTCH GUIANA OR SURINAM.

From information communicated to Kew by Mr. Louis Asser, of the Hague, Holland, the preparation of dried bananas and of banana and plantain meal is proposed to be taken up on a large scale in Dutch Guiana. Already various preparations from this part of the world have been shown at the International Exhibition held at Brussels by an association called the "Stanley Syndicate." Preference appears to be given in this case to the banana on account of its lesser value locally, and because it is believed in Surinam to be a stronger plant "and less liable to be injured by rain and storms which are particularly severe on the plantain." The meal was obtained by slicing the fruit by machinery into thin pieces and drying them in a fruit-drying apparatus. The dried slices were then ground into a meal in a mill and carefully sifted. The analyses of various meals made in Surinam show that the meal prepared from both plantain and banana has almost the same composition. A set of preparations has been forwarded to Kew by Mr. Asser, consisting of the following articles. The list is given in full as it shows the numerous commercial uses to which the fruits of the plantain and banana may be put:—

(1) Dried slices of the entire fruit (pulp and peel) in the starchy state suitable for the preparation of alcohol or for making into a nourishing bread; (2) meal in a starchy state from the pulp only for making into a superior kind of bread or porridge; (3) flakes and meal in a dextrinous state for use in breweries or for making into nourishing soups, puddings, &c. These flakes are of a rich brown colour, and retain the banana flavour. Another preparation, very similar but sweet, is intended for making into wholesome confections, cakes, biscuits, &c.; (5) dried peel and coarse meal prepared from it intended as a feeding material for cattle and pigs; (6) banana marmalade; (7) dried bananas entire and without peel put up like dried figs in boxes; (8) raw alcohol prepared from fresh bananas and also from dried banana meal; (9) sugary syrup of bananas "of agreeable odour and flavour," suitable for confectionery purposes, for preparation of liqueurs and for sweetening champagne; (10) banana meal for the manufacture of glucose and a sample of syrup and sugar prepared from it; (12) fibre of banana and plantain prepared from the discarded stems after fruiting, and intended for the manufacture of paper and cordage.

The use of banana meal in the preparation of alcohol is no doubt borrowed from the example at St. Michael's in the Azores, where since the failure of the orange cultivation sweet potatoes are largely grown, cut into thin slices, ground into meal, and then converted into alcohol. During the year 1884 there was exported from the Azores alcohol of the value of 40,588*l*., made entirely in this manner from the sweet potato.

It is estimated by Mr. Asser that the cost of banana cultivation in Surinam will be at the rate of 2*l*. 10*s*. for every ton of meal. The cost of gathering the crop and making the meal will be at the rate of 18*s*. to 20*s*. per ton; while the cost of freight to Europe will be about 25*s*. per ton. The estimated net cost of delivery of banana meal in Europe is therefore placed at 4*l*. 15*s*. per ton. Considering the market value of the banana meal to be at the same rate as Indian wheat, viz., from 5*l*. 10*s*. to 6*l*. 10*s*. per ton, Mr. Asser claims there would be a margin of profit on banana meal equal to about 15 per cent. on the capital invested.

Erratum.—For "surface" (*Kew Bulletin*, No. 91, p. 224, 21st line), read "Swedes."

ROYAL GARDENS, KEW.

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CCCCVI.—VEGETABLE RESOURCES OF INDIA.

An interesting Memorandum on the Resources of British India has lately been prepared by Dr. George Watt, C.I.E., Reporter on Economic Products to the Government of India. A copy has been communicated to this establishment by the Secretary of State for India in Council. The following extracts will give a general view of the present position, and the probable development of the chief vegetable resources of the Indian Empire :—

British India, as covered by this Memorandum, consists roughly of 699 million acres, which support a population of, say 221½ millions. The agricultural products are grouped as follows :—

(*a*) Food crops (wheat, rice, barley, millets, pulses, sugar, spices, etc.)·
(*b*) Oil-seeds (linseed, rape and mustard, castor, sesamum, ground-nut, etc.).
(*c*) Fibres (cotton, jute, hemp, rhea, silk, wool, etc.).
(*d*) Dyeing and tanning materials (indigo, safflower, *al*, etc.).
(*e*) Drugs and narcotics, etc. (opium, tea, coffee, tobacco, cinchona, indian-hemp, etc.).
(*f*) Miscellaneous products, cutch, lac, india-rubber, palm sugar, cocoa-nut [fibre and oil], myrobalans, etc.

WILD PRODUCTS.

Miscellaneous products, such as cutch, lac, india rubber, are not exactly agricultural crops; but these products form a somewhat significant feature of India as compared with European experience of the present day,—namely, a source of wealth derived from wild or semi-wild animals and plants. The cocoa-nut palm cannot, strictly speaking, be treated as an agricultural crop, though it is regularly planted, and large tracts of country are devoted to it. So, in the same way, the date and palmyra palms are sources of wealth to many parts of India. The *mahwa* tree may be spoken of as one of the most valuable cultivated or semi-cultivated plants of large tracts of country, affording, as it does, food, oil, and alcohol. The *singhara*, or water-chestnut (like the water-cress of Europe) is of considerable importance to wide areas of

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India. On the lower hills and scrubby forest lands the collection of such articles as lac, cutch, india-rubber, wild silks, gums, dyeing and tanning materials, medicinal products, paper-making grasses, etc., etc., afford by no means an insignificant contribution to the resources of the people who inhabit such regions. These non-agricultural crops (as they might be designated) are too numerous to be separately dealt with, and returns of the areas devoted to them cannot be ascertained. We can judge of their value, however, by the returns of foreign and internal trade, so long as it is not forgotten that the major portion of these products are locally consumed, and hence trade statistics give but an imperfect conception of their total value. It may safely be said that in few countries in the world do wild products assume such importance as in India. Not only do the poor eke out their daily subsistence by wild food-stuffs, but in times of scarcity and famine vast communities have been enabled to tide over the ruin that has overtaken them through the the knowledge of the wild products of their country. The husbandry of wild-food materials and the extension of the fuel and fodder supply has accordingly engaged the earnest consideration of the Government of India for many years past.

It is hardly necessary, however, to specialise here and there the wild or semi-wild products that deserve consideration. India can count these by the hundred, and need not, therefore, look to foreign countries for new crops while she has a long list of unexploited products which are running to waste in every lane and jungle of the country. In the writer's opinion, an extension of the effort to bring these hitherto unknown products (unknown to European commerce) into a position of definite recognition, is more worthy of serious consideration than the attempt to acclimatise the plants of other countries. Much might, for example, be done by encouraging the people to grow, as hedges round their fields, useful bushes instead of useless plants that have the exclusive recommendation of rapidity of growth or efficiency of protection. These hedges might, for example, be made more and more fuel reserves, or sources of dyes, tans, fibres, and other such products. This idea seems to be gaining ground far more in the Bombay Presidency than in other parts of India. It is not uncommon in Guzerat and Kathiawar, for example, to find miles of road-sides planted with the ornamental and useful bush, *Cassia auriculata*. But it may safely be said that in Western and Central India, thousands of square miles of country have been overrun by scrubby bushes of *Anona squamosa*. These are serving no useful purpose at present, while the fibre from the bark might be found of value. *Opuntia Dillenii* (the prickly pear), though it affords an inferior fibre, might be utilised; it is a noxious weed, the utilisation of which would be of immense advantage to extensive tracts of country, especially in Southern India. *Bauhinia Vahlii* (the *malu* fibre) is a prevalent climber in the jungles of the lower hills, and might at little cost be cultivated over rocky country at present next to useless. Its fibre has the advantage of being capable of being bleached and dyed by the same processes as wool. At least one, if not two, species of *Abutilon* are wild plants in very nearly every district of India. Their fibres very much resemble that of *Sida*. Another bast fibre, *Pavonia*, is probably superior to *Sida*. *Malachra* was once on a time experimentally grown in Bombay as a substitute for jute, and reported a failure; but even if that opinion be correct, it might very possibly be found a success in Madras or Burma.

These are only a few out of the many fibrous plants of India, and a similar enumeration might be given of dyes, tans, oils, medicines, and even edible substances well worthy of cultivation. It is, in fact, easy to mention many such examples of possible revenue from useless tracts of country, or of wild products which, if experimentally grown, might in a few years rank among the recognised and valued sources of wealth to the country. As matters stand, the physical conditions of large tracts of India are such as to warrant but slight departures from the time-honoured usages of the people. But while admitting all this, it is impossible to accept the verdict of enthusiasts who have pronounced the native systems of agriculture as superior to those of Europe, and who would have us believe that improvement is impossible and undesirable. In relation to existing conditions the native systems are indeed admirable, and need but to be evolved to attain a high state of perfection. But there are few aspects of Indian agriculture in which improvement is not only possible, but in which it is not, as a matter of fact, taking place. Witness, for example, the startling revelation obtained from a study of the present crops of our fields and gardens. Some 50 or 60 of our most generally grown plants came to us, within historic times almost, from other parts of Asia or from Africa and Europe. Of this nature may be mentioned the onion, leek, rape-seed, cabbage, cauliflower, turnip, pomelo, water-melon, coffee, loquat, soy-bean, ochro, lettuce, flax, litchi, poppy, field-pea, apricot, plum, peach, apple, betel-pepper, chena, and Italian millet, &c., &c. So again within still more recent times America has furnished India with many cultivated plants, such as the American aloe, pine-apple, custard-apple, earth-nut, annatto, capsicum and chilies, papaya, cinchona, pumpkin, sweet potato, tomato, arrow-root, tobacco, prickly-pear, guava, Cape-gooseberry, potato, Indian-corn, &c., &c. Turning from our fields and orchards to the avenues and hedgerows, to the jungles and even forests, we find an equally high per-centage of exotics. Indeed, it might be almost said that from Calcutta to Lahore 50 per cent. of the *prevalent* cultivated and wild vegetation has been imported by India within historic times. But were we to eliminate only the plants named, together with the systems of agriculture and horticulture necessitated by these, how much would remain that could be called ancient? There is hardly a district in which the majority of the crops grown are not exotics. Hence it would be as unsafe to assume that everything the Indian agriculturist deals with had descended to him from a remote antiquity as it would be to believe that his present religious and social observances had been derived exclusively from the Vedas. Rather than hold that India is incapable of change, it would be safer almost to believe that her greatest weakness lies in an inherent tendency to appropriate the results of foreign agricultural skill, instead of perfecting and evolving her indigenous resources. Were the origin of the cultivated plants of the world to be expressed to area, India would be found to rank very far down in the scale. She has borrowed far more than she has given, and it would seem, therefore, that the improvement of the future should lie as much as possible in the path of natural selection and evolution of indigenous materials and systems. That improvement of Indian agriculture in these directions is possible and desirable is a point on which it would appear there cannot be two opinions.

POSSIBILITIES OF DEVELOPMENT.

The possibilities of development on new lines are then discussed under the following heads:—

(*a*) Extension and improvement of the supply and quality of existing products; and (*b*) the introduction of new products. These two subjects, it may be said, have engaged the attention of the Agri-Horticultural Societies of India, of the Superintendents of Botanic Gardens, of the Conservators of Forests, and of the Government Departments of Agriculture, for many years past. To enumerate the many useful trees, ornamental shrubs, and valuable crops that have been introduced into India or developed and improved, would fill many pages. A few only need therefore be mentioned. The prosperous industry of tea-planting in India and Ceylon may be said to have emanated from the Botanic Gardens of Calcutta, and to have obtained direct aid from Government until private enterprise was prepared to undertake its further development. To the same institution has to be assigned the honour of having brought cinchona cultivation to its present state of perfection, thus not only giving to the fever-stricken people of India but to the whole world quinine at a price within the means of all. The Forest Department has taken up the question of the conservation of forests, the re-afforestation of denuded tracts, and the extended cultivation of such useful trees as mahogany, india-rubber, &c., &c. The Agri-Horticultural Societies, like the Government Agricultural Departments, have taken an active interest in the introduction of new crops or superior races of existing crops. Such subjects as indigo, jute, cotton, sugar, wheat, sorghum, silk, cattle, sheep, &c., &c., have from time to time been carefully considered and extensive experiments conducted. No small share of the successful development of the trade in these products is therefore due to the societies and departments named.

COTTON.

Little more than a century ago it was felt in England that the time might arrive when India would have to be regarded, from political reasons, as the chief source of supply for cotton. A Polish botanist [Dr. Anthony Pantaleon Hove, employed as a collector for Kew in the last century], was sent out by the then British Government to study the indigenous cotton plants of India. His report, though not published until many years after his death, is full of interest. It shows that the crops grown in Western India a century ago were very different from those of the present day, and that the systems of cultivation pursued, even on the black soils of Guzerat, were in some important respects dissimilar from those now followed. During the first few decades of this century the Honourable the East India Company entertained the somewhat unfortunate opinion that the true way to enable India to participate in the greatly expanding British traffic in raw cotton would be to acclimatise the most highly prized forms of America. Large sums of money were accordingly spent in Bengal, Madras, and Bombay that might (as we now learn) have been used to better advantage in an effort to improve and develop the indigenous crops. Year by year America steadily improved the quality and increased the length of her staple, and the demand for Indian cotton accordingly declined. Ultimately, however, India succeeded in producing New Orleans cotton at Dharwar—a staple of a far superior quality to the Indian. The high price paid for this, unfortunately induced adulteration instead of encouraging greater effort. In July 1863 a law had accordingly to be passed to repress the frauds perpetrated, but this, while being wholly ineffectual in its main object, very frequently punished the wrong persons, and accordingly did great harm to the industry. It was in consequence repealed, and the Indian cotton trade was thus left to take care of itself. The effort to participate in the British traffic had practically to be abandoned, and not because India had been proved incapable of producing a staple of the kind required. But this is not all. The reputation of India for its once famous indigenous cottons had at the same time been completely destroyed, and its American crop having fallen into disfavour, rapidly degenerated in quality, until at the present day it might almost be described as inferior to many of the indigenous cottons. Unskilled and impecunious cultivators were in India left to compete against the enlightened agriculture of America—unskilled because ignorant of the principles by which they might have developed the produce to meet the best market, instead of being content to allow it to drift into an inferior position. As matters stand, they may now be said to glory in that they are able to dispose of a worthless staple at remunerative rates.

That improvement towards a higher and better-paid standard is possible may be accepted as fully demonstrated by past experience and by the fact of superior races of cotton being found where attention is given to the crop, and still more so by the further fact that within the regions of superior production the cultivators are fully aware that degeneration occurs with neglect and with the prolonged continuance of cultivation of any particular form on the same soil. Selection of seed and the cultivation of specially selected plants for the production of seed might easily improve the Indian crop of any district by 50 per cent.

For many years past the Indian cotton trade has been drifting into a restricted groove. Our produce goes to mills that do not wish for a superior or long staple, but only a pure one (that is, not a mixture of several lengths of staple), so that it may fairly be said many of our largest buyers discourage improvement. The dangers of a one-sided trade of this nature need scarcely be mentioned. India is thus destroyed as a possible country of supply for the English mills. The Indian mills are at the same time compelled to look to foreign countries for their present or future supplies of superior staples, and are thus more or less confined in their operations to one class of goods. It might almost be said that progression is deliberately stultified, the labours of centuries ruthlessly thrown away, and a large and important industry practically cornered or restricted in its possible development by interested parties, who advance the plausible axiom that demand is the controlling power of production. Hence improvement of the staple may be emphatically affirmed as the rational direction in which an extension of our production of cotton should be looked for, since the existing traffic is aimed at the destruction of all the good features of the indigenous fibre, if not of the morality of both grower and trader. It is essentially a retrograde traffic, as at present constituted, and one in which the aims and objects of most of those concerned are directed towards the attainment of a high yield of a worthless staple.

What is true of cotton is, however, equally applicable to sugar, wheat, wool—in fact, to almost all the articles of Indian trade. Little or no effort has been put forth towards developing, on scientific principles, the quality of the articles of Indian commerce. Past endeavours have for the most part been concerned with acclimatising the products of other countries, with the result, as already shown, that India has obtained many of her most widely grown crops from foreign sources.

The cottons of India may be referred approximately to two great sections, the early and the late crops. The former comes into market from October to March, the major portion from October to January. The latter does not commence to come into market much before February, and is, as a rule, over by April, though exceptional crops are not ripe before June. The early crops are represented by the "Bengals" (such as the cottons of the Panjab, the North-West Provinces, Oudh, and Bengal), the "Oomras" (the chief cottons of Khandesh, Berar, &c.), the "Hinganghats" (of the Central Provinces, &c.), and many of the Sind cottons. The late crops are represented by the "Dholeras" (important crops of Kathiawar, Kutch, and Guzerat), by the "Broach and Surats," by the "Coomptas" (indigenous cottons of Dharwar, Bijapur, Belgaum, &c.), and by the "Cocondas" and "Tinnevellys." This purposely leaves out of consideration the American cottons, such as "the saw-ghinned Dharwar," "Verawal," "Salems," and "Coimbatores," which are also, however, all late crops. While we have thus a comparatively easy classification according to season, this is at once revealed as more or less the expression of meteorological conditions, since within almost any one of the regions of these crops widely different forms are separately classed in the trade under the names of the districts where produced. These when examined botanically are often found to be afforded by distinct races, varieties, or species. Nothing could convey an idea of the complexity of the Indian cotton traffic more forcibly than a tour through Guzerat during the months of January, February, and March. At Surat and Broach (more especially in the latter district) a high cultivation on a rich black cotton soil is found to yield one of the finest of all Indian long-staple cottons. During the months mentioned, however, the soil is split into great blocks, the cracks penetrating to such a depth as to render perennial crops an impossibility. As the result, trees are very rare and hedges all but unknown. A few miles off, the lighter soils of large portions of Baroda are able to support perennial cottons, trees become frequent, and hedges universal. Here, then, are two cotton crops of the late series growing side by side, but which practically cannot be interchanged from district to district, and in which the systems of cultivation pursued and the quality of the staples afforded are as different as the two plants are from each other. They are botanically, agriculturally, and commercially different things, and have to be treated as such, whether the object desired be to extend the area of cultivation or improve the quality of the staple. A little to the north of Baroda (in Wadhwan and other districts) another change is met with, viz., the occurrence of close-podded forms of Dholera cotton. These are far more dissimilar from Surat, Broach, and certain Baroda cottons than are the Dholeras of the southern division of Kathiawar. Indeed one of the chief forms of Broach has undoubtedly been derived from Kathiawar, so that the trade distinction of "Dholeras" from "Broach and Surats" cannot be upheld botanically. What is more curious, the once famous Laberkhuva cotton of Mongrol was found on inquiry to be Broach cotton raised from seed imported fresh every fourth or fifth year. And these illustrations of Guzerat and Kathiawar cottons are more or less true of the whole of India. There are often very narrow limits indeed within which an extension of the area of cultivation can carried without destroying completely all the special properties of the crop.

The total area in cultivation under cotton in British India in 1892–93 was nearly 9,000,000 acres. The largest areas were in Madras, Berar, Bombay, and the North-West Provinces. The highest export of cotton during the last five years took place in 1889–90, when cotton to the value of 187,000,000 rupees was shipped from India. The export in

1892-93 was slightly less, being of the value of 127,000,000 rupees. Besides cotton, there was exported from India cotton seed in 1888-89 to the value of Rs. 301,577; in 1892-93 this had fallen to a value of Rs. 61,708.

FIBRES.

Among fibrous plants it may be pointed out that while great tracts of India (in the form of hedges) are regularly under the American aloe, the fibre of that plant is not at all utilised. Everything points to the possibility of this large stock of valuable fibre not only being used up, but to its being found profitable to open out aloe-fibre plantations on an extensive scale. So in the same manner the fibre of *Sida* has from time to time been urged on the consideration of the textile world with comparatively little result. Interest may, however, be said to have at last been aroused in this most admirable fibre, and large supplies are being accordingly collected for experimental purposes. One or two enlightened Native gentlemen have more than once been induced to grow the plant, and it is hoped that through their example it may be possible to get the ordinary cultivators to take to it, since it affords a fibre in many respects superior to jute. So, again, while much has been written on rhea fibre, little progress has been made. Numerous inventions have, however, been patented, and it is believed that, should a demand arise, India might largely participate in the supply of this fibre. There are also many most useful fibres known to the people of India which have for centuries been regularly grown to meet local demands. Some of these might be produced on a large scale at low prices, were a trade created for them. Amongst these may be mentioned Sunn-hemp (*Crotalaria juncea*) and Deccan-hemp (*Hibiscus cannabinus*). In the light of the fixation of nitrogen in the soil through the cultivation of plants belonging to the pea family, an extended production of Sunn-hemp would be a positive gain to India.

But the forests and jungles of India are literally teeming with wild fibrous plants, many of which could be grown on a large scale were this found necessary. For example, in the Rajmahal-hemp (*Marsdenia tenacissima*) India possesses a fibre which is far superior to rhea. It has among Indian fibres the highest known per-centage of cellulose, loses considerably less than any other under hydrolysis with soda or acid purification, while its weight is greatly increased by nitration. A line made of it broke when dry at 248 lbs., and when wet at 343 lbs., against a similar line of the finest hemp, which broke at 158 and 190 lbs. But a volume might be written on the unexploited fibres of India, most of which could easily be added to the list of regularly-cultivated crops. If those already mentioned do not suffice, any of the following might be tried:—*Abroma*, *Abutilon*, *Anona*, *Bauhinia*, *Calotropis*, *Helicteres*, *Malachra*, *Musa*, *Pavonia*, *Sesbania*, *Sterculia*, *Villebrunia*, &c., &c.

DYES.

Competition with aniline has ruined many of the Indian dyes, such as safflower and madder, but there seems no good reason why others should not take their places either as regular crops or as important forest products. Among the former may be specially mentioned the *Chay*-root (*Oldenlandia umbellata*) and *Al* (*Morinda citrifolia*), which might be regularly and extensively cultivated, as these plants furnish dyes of a purity and depth of colour that defy imitation. And there appears no reason why a dye-stuff, much after the nature of indigo cakes, could not be prepared from either of these dye-plants, ready, as it were, for immediate use. What has apparently prevented their coming into the European market is the difficulty in utilising them according to Native methods.

The demand for lac far exceeds the supply, and in this product India holds the market. Hitherto the lac of commerce has been drawn from wild sources, but there is nothing to show that the insect might not be regularly semi-domesticated.

INDIGO.

As tea may be said to have been the immediate cause of the separation of America from Great Britain, so indigo may be regarded as the cause of the collapse of the once famous maritime power of Portugal. When we first read of India exporting indigo, it went by the Persian Gulf and Alexandria to Marseilles, where it was known as Bagdad Indigo. In the fifteenth century the new route to India was established and the Portuguese became the chief traders. Amongst other articles they trafficked in indigo, and soon succeeded, in spite of the opposition and persecution of the woad cultivators of Europe, in making that tinctorial reagent a necessity to the European dye-works, especially in Holland. At that time and even down to the seventeenth century the English manufacturers sent their broadcloths to be dyed by the Dutch. Difficulties, however, arose through the absurdly high charges made by the Portuguese for the indigo which they brought to Europe, and through which traffic, very largely, they were enabled to establish their position of the chief shipping agency (so to speak) in the Oriental trade. For nearly a century Lisbon rivalled even Venice as a depôt for Eastern produce, but the skill of the Portuguese stopped short of utilising in home industries the materials which their maritime enterprise brought to their shores. In quarrelling, therefore, with their chief consumers, they directly led to the formation in 1631 of the Dutch East India Company, by whom enough indigo was soon brought to Holland to suffice for the whole of Europe.

It may be said that some doubt still exists as to whether or not the indigo plant can botanically be called indigenous to India. Several very nearly allied species are the "wild indigo" of numerous writers. It is certainly significant that the Sanskrit name *nílá* (or the modern *níl*, *nel*) was not carried to the countries supplied as the name of the new dye. This might be viewed as pointing to the specific application of *nîla* to this particular blue dye (out of the many other plants known in India to yield a similar product) as of comparatively modern date. Further, the industry would appear to have originated on the western side of India (Guzerat and Sind being its home)—a region where its cultivation is quite unknown at the present day, but where the dye still bears the name *gali* (= ? decoction), a name which is used by all the earliest European writers. The Persian and African influence (especially in dyeing and weaving) are even now and have for centuries been so strong on the western side of India as, moreover, to give countenance to the idea of the cultivation and manufacture of indigo having very possibly been introduced by them. This might account for its rapidly spreading to other and better-suited regions. Indeed, it may be suggested that an indigenous industry would almost naturally be expected to have survived in its original home with greater pertinacity than indigo has manifested. It is remarkable also that the plant grown to this day in South India is an American species of the genus quite distinct from that of Bengal.

But leaving aside speculations as to the origin of the industry, it may be said that two circumstances early began to militate against the expansion of the Indian trade in this dye,—(*a*) the discovery of a source of indigo in America, and (*b*) the adulteration practised by the native manufacturers. Adulteration has been for several centuries past, and is so now, the chief cause of other countries being able to deprive India of her natural trade—the adulteration of wheat and cotton are the two most pressing examples at the present day. The French, Spanish, Portuguese, and English colonists accordingly took to indigo cultivation in the West Indies and America, and their enterprise and skill soon ruined or all but ruined the Indian industry. But the troubles that about this time arose in Europe may be said to have restored to India her old industry. The British East India Company, realising that the English manufacturers were now practically dependent on the French and Spanish for indigo, encouraged the establishment of indigo factories in Bengal, and thereby indigo cultivation and manufacture were made to migrate from the western to the eastern side of the country, and from Native to European manufacturers. The price that continues to be paid for Native-made Madras indigo relative to the European Bengal article (or that made by Natives on European principles) shows conclusively that, had the indigo factories been restored by the East India Company to native manufacturers, India could never have recovered from the West Indies this, now one of her most valued industries and articles of export trade. There are in India 2,762 factories and 6,032 vats, and these give employment to 356,675 persons during the working season irrespective of the agricultural labour to produce the plant. . . . . It may be said that in less than 20 years the East India Company restored to India its lost industry. . . . Last year's export of indigo were 126,706 cwts., valued at 41,000,000 rupees.

TANNING MATERIALS.

Every day the outcry for tanning materials is becoming more pressing, and it would therefore seem desirable that an effort should be made to foster the semi-cultivation of some of the better kinds of the indigenous products of this nature, such, for example, as the Babul, *Cassia auriculata*, Myrobalans, the Indian Sumach, Sal, and many others.

Cutch or *Catechu* is the resinous extract obtained by boiling down a decoction obtained from chips of the heartwood of *Acacia Catechu* and occasionally of one or two other Acacias. The practice of preparing this extract has been handed down from a remote antiquity, so that in many parts of the country a distinct people claim this as their hereditary occupation, and take their name as *Khairís* from that of the tree *Khair*. The extract is known to the people of India as *Káth*, hence in some parts of the country the makers of it are known as *Káthkaris*. In Bombay the *Káthkaris* are darker and slimmer than other forest tribes. They have no peculiar language of their own, but in conversation they have a tendency to reduce words and shorten speech and uniformly get rid of the personal, not the tense, inflections of the verb. By the forest conservancy laws many of them are being deprived of the right to cut down Cutch trees, and are therefore taking to other occupations. The existence of a separate people or a people recognisable as different from the other inhabitants of the forests shows how ancient the art of manufacturing this extract must be. The seats of the trade have doubtless been repeatedly changed through the extermination of the tree or the administrative regulations that have prevailed. While to a small extent it is manufactured very nearly in every district of India, there may be said to be three chief forms of ordinary Cutch, viz., "Pegu," from Burma; "Bengal," obtained from Nepal, Kumaon, and to a small extent from Chutia Nagpur; and "Bombay," prepared chiefly in Dharwar, South Konkan, Khandesh, and Surat.

But there are also different qualities (if not perhaps chemically different articles) such, for example, as, 1st, the dark Cutch or Catechu of Pegu and Bombay, which is used for industrial purposes and is the substance exported; 2nd, the Crystalline or pale Catechu (often in trade specifically designated as *Káth* in contradistinction to Cutch), which is prepared in Kumaon and eaten in *pán*, contesting thereby the market of the imported Gambier; and 3rd, *Kersal* or crystalline substance found imbedded in the wood much after the same fashion as the Barus Camphor. Although an effort has been made to recommend the pale Catechu of India as a deserving substitute for the Gambier of European commerce, it is believed little progress has as yet been made. The difference is effected by the method of preparation followed in Kumaon, and hence should a superiority be recognised the exports might easily enough be changed from the dark-coloured blocks at present exported from Pegu and the cakes of Bombay, into the crystalline article, the more so since a simple process of effecting that result has recently been discovered.

The trade in this article cannot, however, be regarded as in a prosperous condition so far as production is concerned, as may be seen from the following table of the exports for the past five years, and by way of comparison those of 1879 to 1884:—

Years.	Cwt.	Rs.	Years.	Cwt.	Rs.
1879–80	222,123	2,813,994	1888–89	290,896	4,423,219
1880–81	316,077	4,222,527	1889–90	221,986	3,334,004
1881–82	198,897	2,580,840	1890–91	156,493	2,363,549
1882–83	246,506	3,052,434	1891–92	197,059	3,172,961
1883–84	302,302	3,532,000	1892–93	229,316	3,824,840

About two-thirds of the exports usually go from Burma and the major portion of the remaining third from Bengal. The United Kingdom takes fully a third of the total exports.

SUGAR.

There are fourteen sugar factories of this nature in India, five in Madras, seven in Bengal, and two in the North-West Provinces. The more important are the Cossipore Sugar Factory (near Calcutta), with a capital of Rs. 1,000,000; the Rosa Sugar Factory, Shahjahanpur, with a capital of Rs. 1,600,000; and the five factories in Madras, viz., the Ask Factory, Ganjam; Parry & Co.'s Factories in South Arcot; and the Tinnevelly Sugar Refining Co. The Sujanpur Factory at Gurdaspur is also a rum distillery.

The history of the Indian sugar trade is very instructive. At first the exports were made exclusively in the very finest crystallised qualities, and went from Bengal, restrictions having been placed on Madras and Bombay from the idea that it was essential that sugar and silk should become the main articles of the East India Company's dealings with Bengal. Had the repressive action of the British Government in imposing a very much higher import duty on East Indian (as the Bengal article was called) than on West Indian sugar not existed, it is probable Bengal would have taken a very high place in the world's production and supply of cane sugar. As matters stood, the honourable company soon found it would not pay to carry Indian sugar to England with a heavy disadvantage placed on the article. In course of time, however, a radical change took place in the demand, through the establishment of English and Scotch refineries. A large export trade sprang up in raw sugar, but the Indian traffic may be said to have then changed from Bengal to Madras. There has, moreover, been a steady decline of the export trade in refined sugar since 1845. But while this change in the location and character of the export trade may be said to be unfortunate, many persons are disposed to view the revolution effected by the still more recent import traffic as fraught with positive danger to the Indian cultivator. But so far it may be said that the yearly increasing foreign supply would not appear to have caused a decline in production. The first effects of the beet sugar of Europe on the Indian trade were (*a*) to close the markets to which India had previously exported refined sugar, and (*b*) to throw on the world large quantities of abnormally cheap cane sugar which sought an outlet in India. In time beet sugar was also exported to foreign markets, and consignments were accordingly made to India, so that we have not only a greatly increased supply of cheap Colonial sugar, but a yearly increasing quantity of a still cheaper article in the beet sugar of Europe. If the refined sugar imported be expressed to the standard of the raw sugar exported, it will be found that India now imports about 7 cwt. for every cwt. exported.

While this altered nature of the Indian sugar traffic has told heavily on the manufacturer and refiner, there is one point of importance that must not be forgotten, namely, that, cheap though refined sugar, no doubt, is, it has in no way as yet affected the consumption of the raw article, which is mainly used in India. It has released the quantity of that article formerly required by the refiners and thus lowered the price, but this has, so far, only extended consumption. The raw sugar used in India, after making a correction for the foreign traffic, comes to 2,600,000 tons, or, say, 28 lbs. per head of population. This reduced to refined sugar would be equal to about 9 lbs.; but there is no occasion to make that reduction, since refined sugar is not likely to be used by the millions of India for many years to come, and the key to the Indian sugar traffic is therefore the relation of the price of imported refined sugar to Indian raw sugar, since by the majority of the people of India the latter will continue to be preferred to the former until a material change takes place, if that be possible, in the relative prices of the two articles.

Formerly imported sugar came mainly from Mauritius, and was imported almost exclusively by Bombay. At the present day the following may be given as the order of importance of supplying countries:—Mauritius, Germany, China, the United Kingdom, the Straits, Austria. The European countries supply beet sugar, but, as manifesting the strenuous efforts that are being made by the foreign countries of supply to obtain a holding in the Indian market, it may be added that not Bombay alone, but all the provinces of India now import foreign sugar. The effect has been disastrous on the Indian refining industry, and hence imported sugar may be said to be rapidly taking the place of Indian refined sugar. The exports of raw sugar (cane and palm) from India in 1892–93 were of the value of nearly 5,000,000 rupees.

TEA.

In 1788 Sir Joseph Banks suggested to the Court of Directors of the East India Company that the effort should be made to cultivate tea in India. Lord William Bentinck, on the eve of his departure for India, accordingly received instructions that he should give the subject his careful consideration. Some eight years previous to Sir Joseph Banks' suggestion, Colonel Kyd had actually raised China tea in the Botanic Gardens of Calcutta. Lord Bentinck, on his arrival in India, lost no time, however, in taking action. A tea committee was founded, with Dr. Wallich as secretary. In addressing his council on the 24th of January 1834, His Excellency made it clear that he was to leave nothing unturned that might help to attain the object aimed at,—viz., the acclimatisation of the best Chinese plants. The tea committee do not appear to have informed Lord Bentinck that Major Bruce (about 1821) and subseqnently Mr. Scott (in 1824) had found the tea plant wild in Assam. Much expense and considerable delay was accordingly incurred in sending several expeditions to China to procure Chinamen and tea-seed, but while a commissioner was actually in China (on behalf of the tea committee) Captains Charlton and Jenkins re-discovered the wild Assam plant.

It is perhaps needless to traverse the somewhat beaten path of the subsequent historic events, the repeated failures but ultimate successful establishment of the tea industry in India. One point may, however, be specially mentioned. It was found (when very nearly too late) that the indigenous plant was far superior to the acclimatised.

The first distinctly public (or commercial sale) of Indian tea was made in the Calcutta market on the 25th May 1841.

The total area under tea in India is 334,845 acres. The exports in 1891–92 from India were 120,000,000 pounds.

At the present day it may be said that Ceylon is now a more formidable rival to India than China. In 1885–86, Ceylon exported not quite 8,000,000 pounds of tea. In 1891–92, Ceylon had increased its exports to nearly 68,000,000 pounds.

COFFEE.

The early history of coffee in India is very obscure. Most writers agree that it was brought to Mysore about two centuries ago by a Muhammadan pilgrim named Baba Budan, who on his return from Mecca brought seven seeds with him. Linschoten, who travelled in South India from 1576 to 1590 and described the countries through which he passed, their people, agriculture, and industries, makes no mention of coffee in India. Tavernier, who journeyed in India in 1665–69, gives a full account of the coffee plantations he visited. Dr. Wallich in his evidence before a Select Committee of the House of Commons, stated that he never drank better coffee than that produced in the Company's garden at Calcutta. Near the Bauria Cotton Mills, a little below Calcutta, may still be seen some of the original coffee plants sown in connexion with an attempt made at the beginning of the century to open out coffee plantations on the plains of Bengal. These old plants continue to bear fruit copiously, and the superintendent of the mills informs the writer that he regularly prepares his own coffee supply from these plants. Though numerous experiments of this nature were conducted all over India, and continue to be made to the present day, coffee planting has attained a commercial position almost exclusively in South India. In British India there were last year 127,548 acres under the crop. But the area devoted to it in Mysore, Travancore, and Cochin would have to be added to that in British territory, thus bringing the total up to more than 200,000 acres. There are 31 coffee works (for cleaning coffee) in the Madras Presidency, giving employment to 1,379 permanent and 5,433 temporary hands. The exports of Indian coffee [in spite of the prevalence of coffee-leaf disease] have shown, if anything, a steady tendency to increase in value if not in quantity. In 1877–78, the exports were 293,587 cwts. of the value of Rs. 1,344,638. Since that time the quantity and value have, with slight fluctuations, risen until 1892–93, when there were exported 299,337 cwts. of the value of Rs. 2,082,439.

CINCHONA.

A statement showing the condition of the Cinchona plantations in British India and the Native States on the 31st March 1893 appears in Appendix IV. to the *Returns of Agricultural Statistics for* 1892–93.

A few particulars are added from it in order to complete the review of the principal agricultural resources of India. The Cinchona plantations are divided into two categories: (1) Government plantations, and (2) private plantations.

Of Government plantations, the Sikkim plantations in Bengal, under the charge of Dr. King, C.I.E., F.R.S., consist of 2,342 acres planted with *Cinchona ledgeriana* (1,000 acres), Cinchona "hybrid" (700 acres), and *Cinchona succirubra* (600 acres). The other Government plantations are in the Madras Presidency on the Nilgiris, under the charge of Mr. M. A. Lawson, M.A. These consist altogether of 900 acres, but the area under each variety has not been reported.

The private Cinchona plantations are situated in the Bengal Presidency at Darjeeling; in the Madras Presidency at Madura, Malabar, the Nilgiris and Coorg; and in the two Native States of Mysore and Travancore. The area under cultivation on private plantations amounts to 6,278 acres. Of these 4,807 are in the Madras Presidency, and chiefly on the Nilgiris. The out-turn of bark for the year 1892–93 from the Government plantations was 423,873 pounds, and from private plantations 1,458,707 pounds; total, 1,872,580 pounds.

On the 31st March 1893 the total number of mature plants on Government and private plantations was estimated at nearly 10,000,000 trees.

WHEAT.

The subject of wheat-growing in India is not separately treated by Dr. Watt in the Memorandum, but from the Table B. in the Appendix, giving the acreage under food crops for the year ending 31st March 1892, we find that the total acreage under wheat in the whole of British India is over 20,000,000 acres. Of this the Punjab has nearly 7,000,000 acres, and the Central Provinces nearly 4,000,000 acres. The value of the wheat exported from India in 1892–93 was over 74,000,000 rupees; but in 1891–92, under exceptional circumstances of demand in Europe, Indian wheat was exported to the value of nearly 144,000,000 rupees.

Dr. Watt remarks: "The fact that India was able to respond, and to thus double her normal exports of wheat, shows that the trade is a perfectly natural one, and one which cannot be regarded as drawing away abnormally the food supply of the people. The production of wheat, cotton, oil-seeds, or other Indian exports, can be readily demonstrated as directly governed by the conditions of the European market. When favourable prices are anticipated the area of production is at once increased." [A Memorandum on wheat cultivation in the Punjab for 1893–94 is given in the *Kew Bulletin*, 1894, p. 167.

CCCCVII.—BOTANY OF THE HADRAMAUT EXPEDITION.

The *Kew Bulletin* for June (p. 194) contained a brief notice of the return of Mr. Bent's expedition to the Hadramaut Valley, and of the botanical collections brought back by it. These were made by Mr. W. Lunt, a member of the gardening staff of the Royal Gardens, who had accompanied Mr. Bent's expedition with the permission of the First Commissioner of Her Majesty's Works and Public Buildings.

About 150 species of flowering plants were secured, a satisfactory result taking into consideration the manifest poverty of the flora; these include about 25 new species and two new genera. Of the former nine will be figured and described in Hooker's *Icones Plantarum*. An enumeration of the whole collection is given below.

RANUNCULACEÆ.

Nigella arvensis, *Linn.*—Amongst crops at Katan, alt. 1,100 feet. A common weed of the Mediterranean and Oriental regions. Native name, "habbeh sôdâ." The seeds are put into bread to assist digestion.

CRUCIFERÆ.

Eruca sativa, *Lam.*—Cultivated at Katan. Roots used as a salad. Native name, "Buckl."

Lepidium sativum, *Linn.*—Amongst crops at Katan, alt. 1,100 feet. The common cultivated cress.

CAPPARIDEÆ.

Cleome arabica, *Linn.*—Near Abrail, alt. 1,800 feet. Extends to Egypt and Algeria.

Cleome ?—Between Tokham and Ghafit, alt. 2,000 feet. A very curious perennial herb, with densely hispid branches and petioles, and small lobed orbicular leaves, with the lobes tipped with large glands. Gathered also by Schweinfurth, in Southern Arabia (Riebeck expedition, No. 178), but unfortunately none of the specimens show either flower or fruit. No doubt it is a *Cleome*, allied to *C. droserifolia*, Delile, Fl. Egypt, 317, tab. 30, fig. 2.

Gynandropsis pentaphylla, *D.C.*—Cultivated fields at Katan, alt. 1,100 feet. A cosmopolitan tropical weed.

Cadaba heterotricha, *Stocks in Hook. Ic.*, tab. 839.—Dense bush, 4 feet high. Between Tokham and Ghafit, alt. 2,000 feet. A very rare species, known also in Scinde.

Mærua uniflora, *Vahl.* (*M. rigida*, R. Br.).—A bush 10 feet high. Al Had, alt. 2,400 feet. In the valleys, widely scattered, but not plentiful. Extends to Senegambia and Angola.

RESEDACEÆ.

Ochradenus baccatus, *Delile.*—Ascends to 2,600 feet. Some of the specimens have curious flattened fasciated stems. Extends to Northern India, the Dead Sea, Egypt, Nubia, and Abyssinia. It grows on sandy banks, but is not common.

Reseda pruinosa, *Delile*, *var.* R. **amblyocarpa**, *Fres.*—In the palace gardens at Alrail, alt. 2,000 feet. Extends to Palestine and Egypt, and is the sole representative of the genus in tropical Africa.

CISTINEÆ.

Helianthemum argyræum, *Baker in Hook. Icon. ined.*—Hills at Dobaibah, alt. 4,000 feet. Allied to *H. kahiricum*, Delile, and *H. Lippii*, Linn.

It is abundant on some of the hills near the coast, and grows in very stony ground.

TAMARISCINEÆ.

Tamarix mannifera, *Ehrenb.*—A shrub 6 feet high, with pendulous branches. Sea level to 200 feet. Extends to Egypt, Persia, and Afghanistan. It is found usually in the dry beds of the valleys.

MALVACEÆ.

Abutilon indicum, *G. Don.*—Side of irrigation channel at Furuth. Now spread through the tropical zone in both hemispheres.

Senra incana, *Cav.*—Shari Burrock Valley, Mokalla, alt. 200–300 feet. Extends to Nubia, Abyssinia, and Scinde.

Gossypium herbaceum, *Linn.*—In the palm garden at Alrail.

STERCULIACEÆ.

Sterculia arabica, *T. Anders.*—A tree 14 feet high, with a bushy head. Tahiyeh, alt. 1,300 feet. Also Aden.

TILIACEÆ.

Grewia populifolia, *Vahl.*—Hills at Dobaibah, alt. 4,000 feet. Extends to Scinde, and is widely spread in tropical Africa.

ZYGOPHYLLEÆ.

Tribulus.—A scrap, gathered by a Bedouin, between Tahiyeh and Alrail, alt. 2,000 feet, is probably a new species of this genus.

Fagonia arabica, *Linn.*—Hills at Ghafit, alt. 200 feet. Also Egypt. Regarded by T. Anderson and Oliver as a variety of *F. cretica*, Linn.

Fagonia Luntii, *Baker*, n.sp.; perennis, ramosissima, ramis foliisque dense breviter pubescentibus, ramulis junioribus teretiusculis multistriatis, foliis brevissime petiolatis omnibus simplicibus, obovatis obtusis basi cuneatis, stipulis spinosis parvis folio brevioribus, floribus solitariis axillaribus breviter pedicellatis, sepalis oblongo-lanceolatis pubescentibus, petalis rubellis sepalis duplo longioribus, fructu globoso mucronato inter coccos acute angulatos profunde sulcato.

Shari Burrock Valley, Mokalla, alt. 100–200 feet. It is found plentifully along the coast growing in sand, but does not extend far inland. *Folia* 3–4 lin. longa et lata. *Sepala* 1 lin. longa. *Petala* 2 lin. longa. *Fructus* 3 lin. diam.

Zygophyllum amblyocarpum, *Baker in Hook. Icon. ined.*
Shari Burrock Valley. Mokalla, alt. 200–300 feet.

Another species from the same locality is perhaps also new, but the flowers are not known. A third, also without flowers, was gathered between Tokham and Ghafit.

RUTACEÆ.

Ruta tuberculata, *Forsk.*—Cleared cultivated ground at Katan, alt. 1,100 feet. Extends from Scinde to Nubia and Algeria.

Peganum Harmala, *Linn.*—Hills at Bir-Backban, alt. 3,500 feet. Extends from Central Asia to North Africa and Spain.

BURSERACEÆ.

Balsamodendron Opobalsamum, *Kunth.* (*Commidendron Opobalsamum*, Engler).—A bush 6–7 feet high. Wadi Hadiea, alt. 2,000 feet. Five other specimens without leaves and flowers, which probably belong to the same species, were collected on the hills at Alghue, alt. 2,000 feet. Engler regards *B. gileadense*, Kunth, and *B. Ehrhenbergii*, Berg., as varieties of *B. Opobalsamum*.

RHAMNEÆ.

Zizyphus Lotus, *Linn.*—A tree 20–30 feet high. Very common in Hadramaut. Native name, "*Ailb.*" Extends through North Africa and South Europe to Spain.

AMPELIDEÆ.

Vitis (Cissus) apodophylla, *Baker*, n.sp.; scandens vel prostrata cirrifera glabra, ramis gracilibus angulatis, foliis sessilibus inferioribus 5-foliolatis, foliolis obovatis obtusis carnoso-membranaceis viridibus profunde irregulariter crenatis superioribus breviter petiolatis infimis sessilibus, cirris oppositifoliis elongatis, cymis magnis laxifloris, pedicellis brevibus, calyce patellari obscure obtuse 4-dentato, fructu globoso glabro magnitudine pisi magni.

Hills at Ghafit, alt. 600 feet. It is found growing amongst large boulders, and in small gorges on the hillsides.

Foliolum terminale 2-2½ poll. longum, 15-18 lin. latum. *Petala* haud visa. *Fructus* 3 lin. diam.

Near the Arabian and Abyssinian *Cissus digitata*, Lam., and the African *C. cymosa*, Schum. et Thonn.

MORINGACEÆ.

Moringa aptera, *Gaertn.*—A small tree 15–20 feet high. At Agum, alt. 2,300 feet. Extends to Abyssinia, Egypt, and Syria.

LEGUMINOSÆ.

Crotalaria striata, *D.C.*—Banks of irrigation channel at Furuth, alt. 2,100 feet. Extends all through the warmer regions of the Old World.

Trigonella Foenum-græcum, *Linn.*—Cultivated at Katan, alt. 1,150 feet. Native name "Kadb."

Indigofera desmodioides, *Baker*, n. sp.; fruticosa, ramulis gracilibus dense persistenter argenteo-incanis, foliis simplicibus distincte petiolatis oblanceolatis obtusis facie tenuiter dorso densius albo-pubescentibus, floribus in racemis axillaribus breviter pedunculatis dispositis, pedicellis brevibus, calyce campanulato dense piloso dentibus tubo brevioribus, petalis calyce quadruplo longioribus, legumine cylindrico 4–6-spermo toruloso primum argenteo demum glabrato.

A bush 4–5 feet high. Wadi Hadiea, alt. 2,000 feet, growing on the hillsides amongst large masses of stone.

Folia 12–18 lin. longa, 3–4 lin. lata. *Calyx* ½ lin. longus. *Fructus* 6–9 lin. longus.

Remarkable for its simple leaves and very torulose pods.

Indigofera spinosa, *Forsk.*—Hillsides near Hajrain, alt. 2,600 feet. Also Egypt, Nubia, and Abyssinia.

Indigofera arabica, *Jaub. et Spach Ill. Pl. Orient.*, tab. 479.—Hillsides near Sibeh, alt. 800 feet. Confined to Southern Arabia.

Indigofera argentea, *Linn.*—Cultivated at Shibam and Katan for the production of an indigo dye. A native of tropical Asia and tropical Africa. It is the *Indigofera tinctoria* of Forskahl, but not of Linnæus.

Tephrosia purpurea, *Pers.*—Between Sif and Hajrain, alt. 2,000 feet. Tropics of the Old and New World.

Tephrosia dura, *Baker*, n.sp.; suffruticosa, ramulis teretibus albo-incanis, stipulis parvis ovato-lanceolatis, foliis trifoliolatis breviter petiolatis, foliolis linearibus obtusis rigide coriaceis pallide viridibus utrinque inconspicue adpresse pubescentibus, venis faciei inferioris prominentibus, floribus solitariis axillaribus pedunculatis, calyce campanulato dentibus deltoideis, legumine lineari polyspermo glabro faciebus subplanis.

Hillsides at Shibam, alt. 2,000 feet. An undershrub 2 feet high.

Folia 12–18 lin. longa, 3 lin. lata. *Petala* ignota. *Fructus* 2–2½ lin. longus, 4 lin. latus.

Allied to *T. purpurea* and *Apollinea*.

Alhagi maurorum, *D.C.*—Hillsides at Sibeh, alt. 500 feet. Also Persia, Syria, and Egypt.

Dolichos Lablab, *Linn.*—Cultivated in the palm garden at Alrail, alt. 2,000 feet.

Vigna sinensis, *Endl.*—Cultivated as a vegetable at Katan, alt. 1,150 feet. Native name "*Dugr.*"

Parkinsonia aculeata, *Linn.*—Shahar, in the cultivated parts at sea-level. A bush 9–10 feet high. Widely cultivated in tropical Asia and Africa.

Tamarindus indica, *Linn.*—Cultivated at Katan, alt. 1,150 feet. Native name "*Amara.*"

Cæsalpinia pulcherrima, *Swr.*—Shari Burrock valley, Mokalla, alt. 200–300 feet. A large tree with a bushy head. Commonly cultivated.

Cassia acutifolia, *Delile.*—Between Tahiyeh and Alrail, alt. 1,700 feet. Extends to Nubia and Timbuctoo.

Cassia adensis, *Benth.*—Bakrain near Mokalla, alt. 200 feet. An erect undershrub 2 feet high, with a bushy head. Only known previously about Aden.

Leguminosa, near **Cercis.** Between Tokham and Ghafit, alt. 200 feet. A bush 2–3 feet high. Probably new, but material too incomplete to describe from.

Acacia spirocarpa, *Hochst.*—Hillsides near Sibeh, alt. 600 feet, and Wadi Hadiea, alt. 2,000 feet. A bush 6–15 feet high. Extends to Nubia and Abyssinia.

Acacia campophila, *Schweinf.*—Hajrain, alt. 2,600 feet. A bush 3–4 feet high. South Arabia only.

Acacia hamulosa, *Benth.*—Common on the hills and plateaux from 500 to 3,000 feet. South Arabia only.

Acacia near Catechu, *Willd.* — Cultivated ground that has been cleared of crops at Katan, alt. 1,100 feet.

COMBRETACEÆ.

Terminalia Catappa, *Linn.*—Planted at Chail-ba-Wazir, alt. 650 feet.

Anogeissus Bentii, *Baker in Hook. Icon. inedit.*—A tree 30 feet high, with pendulous branches. Ghail-Omar, alt. 2,200 feet. The flowers are very sweet scented.

LOASEÆ.

Kissenia spathulata, *R. Br.*—Alrail, alt. 2,000 feet. An erect herb 1–2 feet high. Only known before at Aden and the Cape. All the other species of the order are confined to America.

LYTHRARIEÆ.

Lawsonia inermis, *Linn.*—Cultivated at Katan, alt. 1,150 feet. Native name "*Henna.*"

CUCURBITACEÆ.

Citrullus Colocynthis, *Schrad.*—Between Sibeh and Tahiyeh, alt. 900 feet. Extends from India to Spain and the Cape Verde Islands.

Cucumis prophetarum, *Linn.*—Same station as the last. Widely spread in tropical Africa and tropical Asia.

Corallocarpus parvifolius, *Cogn.*—On the hills near Gambla. Endemic.

UMBELLIFERÆ.

Carum copticum, *Benth.*—Cultivated at Katan, alt. 1,150 feet. Native name "*Zamoota.*"

Foeniculum officinale, *All.*—Cultivated at Katan, alt. 1,150 feet. Native name "*Shamar.*"

RUBIACEÆ.

Oldenlandia Schimperi, *T. Anders.*—Between Ghafit and Sibeh, alt. 600 feet. Extends from Scinde to Nubia.

COMPOSITÆ.

Vernonia cinerea, *Less.*—Irrigation channel at Khailah, alt. 3,000 feet. Widely spread in tropical Asia and tropical Africa.

Geigeria alata, *Benth. et Hook. fil.*—Dry cultivated ground at Katan, alt. 1,100 feet. Extends through tropical Africa to Namaqua land.

Pluchea Dioscoridis, *D.C.*—Tokham, near Mokalla, alt. 200 feet. Extends to Palestine and through tropical Africa to Natal.

Francœuria crispa, *Cass.*—Hills at Khailah, alt. 3,000 feet. Extends from India to Senegambia and the Cape Verdes.

Pulicaria leucophylla, *Baker*, n.sp.; suffruticosa, ramulis foliisque utrinque dense persistenter albo-tomentosis, foliis obovato-cuneatis distincte petiolatis supra medium crenatis, capitulis radiatis magnis solitariis terminalibus pedunculatis, involucro campanulato, bracteis linearibus acuminatis pauciseriatis laxe albo-pilosis, ligulis multis parvis luteis, acheniis angulatis glabris, pappo albo biseriato radiis exterioribus parvis interioribus setosis ciliatis achenio triplo longioribus.

Growing on sandy or stony undulating ground.

Between Tokham and Ghafit, alt. 200 feet.

Folia 4–6 lin. lata. *Involucrum* 6–7 lin. diam. *Pappus* 1½–2 lin. longus. *Ligulæ* luteæ 1½–2 lin. longæ.

Iphiona subulata, *Baker*, n.sp.; suffruticosa, ramosissima, glutinosa, foliorum segmentis cylindricis elongatis facie leviter canaliculatis apice acutis haud pungentibus, capitulis homogamis parvis laxe corymbosis, involucro obconico, bracteis lanceolatis rigide coriaceis glabris adpressis exterioribus sensim brevioribus, floribus involucro, æquilongis, achenio oblongo glabro multisulcato, pappi setis rigidis albidis involucro triplo longioribus.

Shari Burrock valley, Mokalla, alt. 200–300 feet, growing on stony hillsides.

Foliorum segmenta 6–9 lin. longa. *Involucrum* 2–3 lin. diam. *Pappus* 1½ lin. longus.

Gnaphalium indicum, *Linn.*—Irrigation channel at Khailah, alt. 3,000 feet. A common tropical weed originating from the Old World.

Lactuca spinosa, *Lam.*—Hills at Disbeh, alt. 4,000 feet. Extends to Spain and the Canary Islands.

PRIMULACEÆ.

Samolus Valerandi, *Linn.*—Sides of irrigation channels at Khailah, alt. 3,000 feet. Cosmopolitan.

PLUMBAGINEÆ.

Statice teretifolia, *Baker in Hook. Icon. ined.*—Between Tokham and Ghafit.

SALVADORACEÆ.

Salvadora persica, *Linn.*—Shibam, alt. 1,000 feet. A small tree, growing in dense clumps, usually in sandy soil in the beds of the valleys. Widely spread both in tropical Asia and tropical Africa.

APOCYNEÆ.

Rhazya stricta, *Decaisne.*—Between Tokham and Ghafit, alt. 2,000 feet. Extends to Afghanistan and Scinde. Plentiful throughout the Hadramaut; the flowers are very sweet scented.

Adenium micranthum, *Stapf,* n.sp., trunco basi incrassato, ramis crassiusculis lignosis cortice nigricante, foliis in ramorum apicibus congestis late obovatis basi subcuneatis apice obtusissimis mucronulatis glabris nervis lateralibus 8–9 subpatulis distinctis, floribus paucis fasciculatis, pedicellis brevissimis, bracteis linearibus lanceolatisve ut inflorescentia tota villosulis, calyce ad ⅔ in segmenta lanceolata diviso, corollæ roseæ tubo ad ⅓ anguste cylindrico abhinc obconico dilatato extus villosulo intus lineis villosis 5 notato lobis late ovatis acutiusculis, staminum caudis filiformibus sub apice clavato incrassatis villosulis longe exsertis.

Dobaibah, alt. 4,000 feet.

Frutex pedalis. *Folia* 1½–2 poll. longa, 1–1½ poll. lata. *Calyx* 5 lin. longus. *Corollæ* tubus 9 lin. longus, lobi 4½ lin. longi. Caudorum *staminum* pars exserta 4–4½ lin. longa.

The leaves are exactly like those of small specimens of *Adenium arabicum,* Balf. f., to which the species is certainly nearly allied. The branches, however, are more woody and the flowers considerably smaller and of a somewhat different shape, the widened part of the corolla tube being obconical. The calyx is deeper divided with narrower segments, and the tail-shaped appendages of the stamens are very much more exserted than in *A. arabicum,* Balf. f.

ASCLEPIADEÆ.

Calotropis procera, *R. Br.*—Between Sibeh and Tahiyeh, alt. 700–1,300 feet, widely spread in both tropical Africa and tropical Asia.

Gomphocarpus setosus, *R. Br.*—Hills near Bir Backban, alt. 3,500 feet. Extends to Abyssinia, stony ground, bed of valley.

Sarcostemma stipitatum, *R. Br.*—Hills at Sibeh, alt. 750 feet. A thick-stemmed dwarf leafless shrub. Confined to southern Arabia.

Caralluma subulata, *Decaisne.*—Same station as the last. Confined to southern Arabia.

Another *Caralluma* without flowers was collected between Tokham and Ghafit.

Caralluma flava, *N. E. Brown*, n. sp.; ramis tetragonis ramosis glabris angulis acutis dentatis dentibus brevibus late triangularibus patentibus, umbellis terminalibus sessilibus multifloris, pedicellis elongatis glabris, sepalis lanceolatis acutis glabris, corolla subrotata lutea tubo brevi campanulato lobis patentibus oblongis acutis vel subacutis marginibus reflexis glabris, segmentis coronæ exterioris profunde bifidis lobis subulatis arcuato-divaricatis, segmentis coronæ interioris linearibus obtusis antheris incumbentibus apice non productis.

Wadi Hadiea, 2,000 feet. It is found on the hillsides amongst large stones.

Planta 6–8 poll. alta. *Rami* $\frac{1}{2}$–$\frac{3}{4}$ poll. diam. *Pedicelli* 5–7 lin. longi. *Sepala* 1 lin. longa. *Corollæ* tubus $\frac{1}{8}$ poll. longus, lobi 4–5 lin. longi., $1\frac{1}{2}$–2 lin. lati. *Coronæ* exterioris lobi $\frac{1}{2}$ lin. longi.

Probably allied to *C. aucheriana*, N. E. Br., of which I have seen no flowering specimens, but according to the description of the flowers of that species given by Boissier, this plant clearly differs by its long pedicels and much larger corolla.

Caralluma Luntii, *N. E. Brown*, n. sp.; caulibus ramosis crasso-carnosis tetragonis glabris pallide viridibus purpureo-marmoratis angulis obtusis grosse dentatis dentibus conico-aculeiformibus patentibus, floribus 1–3 prope apicem ramorum fasciculatis longe pedicellatis, pedicellis glabris, sepalis lanceolato-subulatis reflexis glabris, corolla fere ad basin quinque-lobata tubo nullo lobis elongatis linearibus incurvato-erectis conniventibus marginibus replicatis intus minutissime puberulis infra medium viridi-flavescentibus parte superiore marginibusque purpureis, coronæ lobis exterioribus ad sacculos minutos ad apicem columnæ stamineæ validæ cylindricæ reductis, interioribus lineari-oblongis acutis denticulatisque antheris arcte incumbentibus eas vix excedentibus, corona cum columna staminea tota purpurea.

Habitat.—South Arabia, on hills near Dobaibah, growing at the base of other plants, 4,000 feet, Feb. 1894, Lunt., 209.

Planta usque ad 6–8 poll. alta. *Rami* $\frac{1}{2}$–$\frac{3}{4}$ poll. crassi. *Dentes* 4–5 lin. longi. *Pedicelli* 4–10 lin. longi, $\frac{2}{3}$ lin. crassi. *Sepala* 1 lin. longa. *Corollæ* lobi 8–9 lin. longi., $\frac{1}{2}$ lin. lati (explicati 1 lin. lati). *Columna* staminea cum corona, $\frac{1}{8}$ poll. longa. *Coronæ* lobi interiores, $\frac{2}{3}$ lin. longi.

A very distinct and easily recognised species. In the other species known to me the corona, or at least the base of the staminal column, is more or less included in a short tube or depression at the base of the corolla, but in *C. Luntii* the base of the corolla is flat, with the corona raised well above it on the stout staminal column, which is of equal diameter with the corona.

Strobopetalum, *N.E. Brown* [Cynanchearum genus novum]. Calyx 5-partitus. Corolla campanulata, alte 5-fida, lobis patentibus dextrorsum contortis sinistrorsum obtegentibus. Coronæ lobi 5,

basi antherarum adnati, plani, erecti. Columna staminea prope basim corollæ affixa; antheræ lineares erectæ membrana terminatæ; pollinia in quoque loculo solitaria, pendula. Stylus apice truncatus vel convexus. Folliculos non vidi. Herbæ suffruticesve volubiles vel prostratæ. Folia opposita. Cymæ umbelliformes, sublaterales, subsessiles vel pedunculatæ. Flores pedicellati parvuli.

This genus is very closely allied to *Pentatropis*, but differs in having a distinct campanulate tube to the corolla, with the lobes much more twisted in the bud and the coronal lobes dorsally flattened and thin, not laterally flattened, as in *Pentatropis*.

S. Benti, *N. E. Brown*; caulibus volubilibus gracilibus ramosis glabris, foliis petiolatis oblongis vel elliptico-oblongis obtusis mucronatis basi leviter cordatis glabris, cymis umbelliformibus pedunculatis plurifloris, pedunculis glabris, bracteis minutis ovatis acutis cum pedicellis sepalisque ovato-lanceolatis acutis minute pubescentibus, corollæ tubo campanulato, lobis linearibus patentibus tortis extus glabris intus basi cum tubæ fauce dense et minute adpresso-pubescentibus, coronæ lobis erectis linearibus acutis basi adnatis antheras æquantibus.

Chail-ba-Wazir, 250 feet.

Foliorum petioli 2½-4 lin. longi, laminæ ⅔–1⅛ poll. longa, ⅓–⅔ poll. lata. *Pedunculi* 3–5 lin. longi. *Pedicelli* 2–3 lin. longi. *Sepala* ¾ lin. longa. *Corollæ* tubus 1 lin. longus. *Coronæ* lobi ½ lin. longi.

Boragineæ.

Heliotropium drepanophyllum, *Baker*, n. sp.; suffruticosum, ramulis lignosis teretibus dense breviter pilosis, foliis subcylindricis ad nodos dense fasciculatis utrinque dense persistenter pubescentibus nullo modo undulatis sessilibus vel brevissime petiolatis, cymis dense multifloris scorpioideis furcatis terminalibus ebracteatis, sepalis ovatis dense pilosis, corollæ tubo subcylindrico utrinque glabro calyce longiori, lobis linearibus obtusis reflexis, genitalibus in tubo inclusis, stigmate supra annulum elongato-conico.

Growing in the sandy or stony beds of valleys between Tokham and Ghafit, alt. 200 feet.

Folia 6–12 lin. longa. *Sepala* 1½ lin. longa. *Corollæ* tubus 2 lin. longus.

Belongs to the section *Radula* of Bunge, in which it is easily distinguished by its subcylindrical, densely fascicled uncrisped leaves.

Heliotropium congestum, *Baker*, n. sp.; perenne, ramosissimum, ubique albido-setosum, foliis parvis oblongis complicatis undulatis subsessilibus basi cuneatis, cymis scorpioideis brevibus densissimis terminalibus ebracteatis, sepalis oblongis obtusis densissime hispidis, corollæ tubo cylindrico extus piloso intus glabro calyce paulo longiori, lobis minutis orbicularibus, genitalibus in tubo inclusis, stigmate supra annulum elongato-conico.

Sandy plains between Ghafit and Sibeh, alt. 600 feet.

Folia, 3 lin. longa. *Sepala*, 1½ lin. longa.

Belongs to the section *Radula* of Bunge, near *H. persicum*, Lam.

Heliotropium Eichwaldi, *Steud.*—Hills near Hajrain, alt. 2,600 feet. Extends from Central Asia to Servia and Italy.

Heliotropium strigosum, *Willd.*—Hills near Sibeh and Dobaibah, alt. 600–3,000 feet. Widely spread in tropical Asia and tropical Africa.

Heliotropium longiflorum, *Hochst. & Steud.*—Palm garden at Alrail, alt. 2,000 feet. Extends through tropical Africa to Angola.

CONVOLVULACEÆ.

Convolvulus microphyllus, *Sieber.*—Under date-palms at Katan, alt. 1,100 feet. Extends to Egypt and Nubia.

Convolvulus hadramauticus, *Baker*, n. sp.; suffruticosus, erectus, ramulis duris gracilibus teretibus glabris erecto-patentibus inermibus, foliis paucis parvis oblongis acutis argute serratis ad basin angustatis sessilibus vel subsessilibus, floribus solitariis lateralibus brevissime pedunculatis, calyce pilis patentibus pallide brunneis densissime vestito sepalis ovatis subæqualibus valde imbricatis, corollæ tubo infundibulari glabro calyce duplo longiori, limbo vix lobato, genitalibus in tubo inclusis, filamentis glabris antheris longioribus, ovario glabro stylo elongato.

Growing on stony, undulating ground between Tokham and Ghafit, alt. 200 feet.

Folia 3–4 lin. longa. *Sepala* 5–6 lin. longa. *Corolla* pollicaris.

Belongs to the section *Spinescentes* of Boissier, near *C. Dorycnium*, Linn.

SOLANACEÆ.

Solanum sepicula, *Dunal.*—Irrigation channel at Furuth, alt. 2,100 feet.

Also Upper Egypt.

Solanum Melongena, *Linn.*—Cultivated at Katan, alt. 1,150 feet. Native name "*Yundahl.*"

Solanum coagulans, *Forsk ?*—Alrail, alt. 2,000 feet. Extends to Palestine and through tropical Africa.

Solanum pubescens, *Willd.*—Gambla, alt. 1,000 feet.

Also Southern India.

Nicotiana Tabacum, *Linn.*—Cultivated at Chail-ba-Wazir, alt. 250 feet. Native name "*Tambac.*"

Withania somnifera, *Dunal.*—Hills at Alrail, alt. 2,000 feet. Extends to India and the Canary Islands.

Capsicum annuum, *Linn.*—Cultivated at Katan. Native name "*Busbas.*"

Datura alba, *Nees.*—Alrail, alt 2,000 feet. Perhaps only cultivated here. It is regarded by Mr. C. B. Clarke as a variety of *D. fastuosa*, Linn., which is widely spread through the tropics of the Old World.

SCROPHULARINEÆ.

Verbascum Luntii, *Baker*, n. sp.; bienne, caulibus foliisque utrinque persistenter albido-tomentosis, foliis oblongis obtusis crenulatis ad basin attenuatis inferioribus petiolatis, racemo simplici laxo elongato, floribus sæpissime solitariis raro binis brevissime pedicellatis, bracteis ovatis minutis, calyce glabrato tubo brevi lobis ovatis, fructu ovoideo glabro calyce triplo longiori.

Hillsides at Alrail, alt. 2,000 feet.

Folia inferiora 4–5 poll. longa, medio 12–15 lin. lata. *Racemus* 6–9 poll. longus. *Corolla* ignota. *Fructus* 2–2½ lin. longus.

Belongs to the section *Leiantha* of Bentham.

Herpestis Monniera, *H. B. K.*—Sides of a brackish pool at Ghafit, alt. 600 feet. Cosmopolitan.

Schweinfurthia latifolia, *Baker in Hook. Icon. inedit.*—Shari Burrock Valley, Mokalla, alt. 200–300 feet.

ACANTHACEÆ.

Blepharis edulis, *Pers.*, *var.* **congesta,** *Rolfe*; foliis parvis congestis, bracteis sericeo-hirsutis.—Near Shibam, at 1,000 feet elevation. A very curious form, but perhaps only a variety of the common and widely diffused *Blepharis edulis*, Pers. It differs in having small, narrow, rather numerous leaves, from 4 to 9 lines long, very hairy bracts, broader, more membranaceous and more hairy sepals, shorter pale blue corolla, and stouter filaments. There is nothing like it in the extensive series at Kew, and if the differences prove constant it may have to take specific rank.

Barleria Hildebrandtii, *S. Moore.*—Hills near Dobaibah, at 4,000 feet elevation, n. 216. Previously known from Somali Land and Aden.

Barleria triacantha, *Hochst.*—Sibeh, at 750 feet elevation. The leaves are much more canescent than in the type, and may belong to a different species, but the specimens are far advanced in fruit.

Anisotes trisulcus, *Nees*—Between Tahiyeh and Alrail, at 1,500 feet elevation. Also Arabia Felix.

Ecbolium linnæanum, *Kurz.*—Near Hajrain, Hadramaut, at 2,600 feet elevation. Widely dispersed in India, Arabia, and tropical Africa.

Bentia, *Rolfe* [Genus novum]. Calyx profunde 5-partitus, segmentis lineari-lanceolatis acuminatis subæqualibus. Corollæ tubus brevis, superne paullo ampliatus; limbus bilabiatus, labio postico interiore erecto incurvo galeato integro, antico patente tridentato palato convexo venoso. Stamina 2, antica, fauci affixa, filamentis basi villosis galea brevioribus; antheræ 2-loculares, loculis dissitis, altero altius affixo, inferiore basi calcarato; pollinis grana ellipsoidea, lateraliter late trilineata, lineis lævibus, triporosa, minutissime reticulata. Discus cupularis. Ovarium breve, villosum; stylus apice integer; ovula in quoque loculo 2. Capsula ignota.

Bentia fruticulosa, *Rolfe*; fruticosa ramosa, ramis canescentibus teretibus, foliis breviter petiolatis obovato-oblongis v. obovatis obtusis tomentosis coriaceis, spicis terminalibus brevibus, bracteis late ellipticis v. elliptico-oblongis obtusis margine crenulatis scariosis, calyce glanduloso-pubescente, corolla pubescenti ampla alba palato brunneo-venoso.

Near Gambla, at 1,000 feet elevation.

Fruticulus 2-3 ped. altus (*Lunt*). *Folia* 3-9 lin. longa, 1½-4 lin. lata. *Spicæ* ½-1½ poll. longæ. *Bracteæ* 4-5 lin. longæ, 3-3½ lin. latæ. *Calyx* 5 lin. longus. *Corolla* 1 poll. longa.

A distinct and interesting plant with much branched shrubby habit, and small leaves, though otherwise much resembling *Rungia* in structure and in its scariously margined bracts. Dr. G. Lindau, however, who has recently been working at *Acanthaceæ*, and who has seen part of the specimen, would place it near *Duvernoia*, E. Mey. (which is reduced to *Adhatoda* in the "Genera Plantarum"). Both these genera are referred to his tribe *Odontonemeæ* (Engl. Bot. Jahrb. XVIII., p. 56), but to different subtribes, on account of certain characters of the bracts, which latter would place our plant near to *Rungia*. Mr. Lunt notes the flowers as white with some brown markings on the lower part of the corolla. The pollen is ellipsoidal and reticulated, with the exception of three broad smooth bands which do not meet at the ends, and in the centre of which the three pores are placed.

OROBANCHACEÆ.

Cistanche rosea, *Baker in Hook. Ic. ined.*—Tokham, near Mokalla, alt. 200 feet, parasitic on the roots of *Pluchea Dioscoridis*.

Orobanche cernua, *Loefl.*—Same locality as the last; also on the roots of *Pluchea Dioscoridis*.

VERBENACEÆ.

Lippia nodiflora, *Rich.*—Chail-ba-Wazir, alt. 2,000 feet. Warmer regions of both hemispheres.

LABIATÆ.

Lavandula Nimmoi, *Benth.*—Bakrain, near Mokalla, alt. 200 feet. Also Socotra.

Lavandula macra, *Baker*, n.sp.; suffruticosa ramosissima, ramulis gracilibus elongatis superne tetragonis tenuiter albo-incanis, foliis propriis obsoletis, spicis laxis cylindricis, bracteis ovato-lanceolatis calyce brevioribus, calyce tubo cylindrico pubescente conspicue nervato, dentibus ovato-lanceolatis æqualibus tubo triplo brevioribus, corollæ tubo cylindrico calyce subduplo longiori, labiis perparvis.

Hillsides at Khailah, alt. 3,000 feet.

Caules 1-2-pedales. *Calyx* 2 lin. longus.

Belongs, like the last, to the subgenus *Cœlostachys*, near *L. subnuda*, *Benth.*

Tinnea arabica, *Baker*, n.sp.; fruticosa, ramulis dense breviter pilosis, foliis oblanceolatis parvis sessilibus integris utrinque hispidis, floribus axillaribus pedicellatis solitariis vel fasciculatis, bracteolis ovatis ad calycem adpressis, calyce glabro labiis latis obtusis integris, corollæ tubo campanulato lobis orbicularibus, staminibus ad tubi basin insertis antheris pilosis filamentis æquilongis vel longioribus.

Grows in very dry stony places, but is not at all common. Hillsides at Gambla, alt. 1,000 feet.

Suffrutex 2-3-pedalis. *Folia* 3-4 lin. longa. *Calyx* floriferus 4 lin. longus, post anthesin accrescens. *Corolla* 6-7 lin. longa.

This is the first time this curious genus has been found out of Africa. About half a dozen species are now known, two of which extend to the Cape.

Teucrium Polium, *Linn.*—Hills near Dobaibah, alt. 4,000 feet. Extends to Somali Land and through Southern Europe, Northern Africa, and eastward into Persia.

ILLECEBRACEÆ.

Xeractis arabica, *Oliver in Hook. Icon. ined.*—Between Ghafit and Sibeh, alt. 600 feet.

AMARANTACEÆ.

Amarantus chlorostachys, *Willd.*—Cultivated at Ghatan, used as a vegetable. Native name, "*Dadh.*"

Aerva javanica, *Juss.*—Between Tokham and Ghafit, alt. 200 feet. Widely spread in tropical Asia and tropical Africa.

Saltia papposa, *Moquin.*—Hillsides at Sibeh, alt. 750 feet; a bush 3–4 feet high. Confined to Southern Arabia.

CHENOPODIACEÆ.

Salsola hadramautica, *Baker*, n.sp.; fruticosa, ramosissima, ramulis albo-pubescentibus, foliis parvis ovatis amplexicaulibus obtusis carnosis utrinque albo-tomentosis, floribus subsessilibus axillaribus, perianthii fructiferi segmentis dorso alâ lata rigidula rotundata basi cuneata præditis, supra alam ovatis pilosis mucronatis.

Sharri Burrock Valley, Mokalla, alt. 200–300 feet.

Perianthium fructiferum 6–7 lin. diam. *Folia* 1–1½ lin. longa.

The genus Salsola is not found to extend far inland, but is not uncommon in the small valleys near the sea, growing in sandy stony ground.

Allied to *S. fœtida*, Delile, and *S. verrucosa*, Bieberst.

Salsola leucophylla, *Baker*, n.sp; fruticosa, ramosissima, ramulis gracillimis teretibus albo-tomentosis, foliis confertis alternis oblongis ad basin angustatis utrinque gibbosis persistenter albo-tomentosis, floribus sessilibus axillaribus, perianthii fructiferi segmentis dorso alâ rigidula rotundata basi cuneata præditis, supra alam ovato-lanceolatis pilosis incurvatis.

Growing in stony ground in the beds of the valleys, between Sibeh and Ghafit, alt. 600 feet.

Folia 1 lin. longa. *Perianthium*, fructiferum 4 lin. diam.

Nearly allied to the last, from which it differs in the shape of its leaves and smaller matured perianth.

Salsola cyclophylla, *Baker*, n. sp.; fruticosa, ramosissima, ramulis gracilibus teretibus albo-incanis, foliis perparvis alternis confertis ascendentibus suborbicularibus carnosis albo-incanis, floribus sessilibus axillaribus, perianthii fructiferi segmentis alâ rotundata crenulata rigidula basi cuneata præditis, supra alam ovatis dense pilosis incurvatis.

Shari Burrock Valley, near Mokalla, alt. 200–300 feet.

Folia vix 1 lin. longa. *Perianthium* fructiferum 2 lin. diam.

Very near *Holothamnus Botta*, Jaub. et Spach, Ic. Plant. Orient., tab. 136.

ARISTOLOCHIACEÆ.

Aristolochia bracteata, *Retz.*—Hills at Hajrain, alt. 2,600 feet. Extends from India to Abyssinia.

Aristolochia rigida, *Duch.*—Gambla, alt. 500 feet. A very distinct species, only known previously in two or three places in east tropical Africa.

THYMELÆACEÆ.

Arthrosolen sphærocephalus, *Baker*, n. p.; suffruticosa, ramulis teretibus adpresse pubescentibus, foliis confertis sessilibus linearibus ascendentibus rigidulis glabris, floribus luteis in pilis immersis in capitulum globosum terminalem aggregatis, bracteis magnis foliaceis reflexis ovatis vel oblongis pilosis, perianthii tubo cylindrico extus piloso lobis parvis orbicularibus, staminibus prope tubi apicem biseriatis.

Hills at Chail-ba-Wazir, alt. 3,000 feet, and Nehar, alt. 2,900 feet.

Folia 9–10 lin. longa. *Capitula* 6–9 lin. diam. *Bracteæ* 5–6 lin. longæ. *Perianthii* tubus 3 lin. longus, limbus 1½ lin. diam.

Nearly allied to *A. somaliense*, Franchet, from which it differs in its foliaceous bracts and orbicular perianth lobes.

LORANTHACEÆ.

Loranthus curviflorus, *Benth.*—Near Sibeh, alt. 600 feet. Extends to Abyssinia and Somali Land. It grows both upon Acacias and Zizyphus.

EUPHORBIACEÆ.

Euphorbia Schimperi, *Presl.*—Hills between Ghafit and Sibeh, alt. 600 feet. Confined to Southern Arabia, where it was first collected by Forskahl, who referred it to *E. Tirucalli*, Linn., which it closely resembles.

Euphorbia (Rhizanthium) hadramautica, *Baker*, n. sp.; perennis, inermis, caule erecto crasso carnoso cylindrico vel ovoideo sursum foliorum delapsorum cicatricibus notato, foliis synanthiis ad caulis apicem dense rosulatis petiolatis lanceolatis vel oblongo-lanceolatis obtusis pubescentibus, pedunculis brevissimis monocephalis, involucro campanulato basi bracteis 2 parvis ovatis foliaceis suffultis, glandulis marginalibus orbicularibus pilosis, ovario piloso.

It is found only in very small numbers on rough stony ground, particularly on the tops of the hills which are flat. The specimens were obtained from Bir-Backban, at an elevation of about 3,500 feet.

Caulis 9–12 lin. longus, 6–9 lin. diam. *Folia* 9–12 lin. longa. *Involucrum* 2 lin. longum.

Belongs to the small section *Rhizanthium* of Boissier, and is nearly allied to the Indian *E. nana* of Royle, and the Madagascar *E. primulæfolia*, Baker. Living plants were brought home, and it is now flowering at Kew.

Jatropha.—Hills near Sibeh, 750 feet. A shrub, with large pungent spines. Material too incomplete for its determination.

Ricinus communis, *Linn.*—Cultivated parts at Shiban, Alrail, and between Sibeh and Tahiyeh.

URTICACEÆ.

Ficus Carica, *Linn.*—A straggling bush. Hills at Khailah, alt. 3,000 feet.

Ficus salicifolia, *Vahl.*—Between Tahiyeh and Alrail, alt. 1,800 feet. Extends to east tropical Africa.

AMARYLLIDEÆ.

Vellozia (Xerophyta) arabica, *Baker. in Hook. Icon. ined.*—Edge of the rocks at Dobaibah, alt. 4,000 feet. About a dozen species of Vellozia are now known in tropical Africa, Madagascar, and the Cape. This extends the range of the genus to Southern Arabia. This species was only seen in this particular locality and not in very large numbers; the situation was damper than any which had previously been seen.

LILIACEÆ.

Asparagus abyssinicus, *Hochst.*—Hills at Dobaibah, alt. 4,000 feet.

Dracæna serrulata, *Baker*, n. sp.—One of the Dragon's-blood Dracænas, allied to *D. Draco*, *Cinnabari*, *Ombet*, and *schizantha*, from all of which it differs by its minutely serrulate leaves. The leaves are ensiform, very thick and rigid, flat on the face, and convex on the back, an inch broad above and 3 inches broad at the dilated base. It was not seen either in flower or fruit. It grows with the two last on the hills at Dobaibah, at an elevation of 4,000 feet.

Asphodelus fistulosus, *Linn.*—In a cultivated crop near Shiban, alt. 2,000 feet. Extends from India to Spain.

Allium ascalonicum, *Linn.*—Cultivated at Shiban. Native name, "*Buol.*"

Allium sativum, *Linn.*—Cultivated as a vegetable at Katan. Native name, "*Thome.*"

Aloe Luntii, *Baker* n. sp.; breviter caulescens, caule simplici, foliis distichis vel subdistichis confertis lanceolatis inermibus recurvatis crassis albo-viridibus immaculatis facie caniculatis, racemis laxis elongatis paniculatis, bracteis parvis ovatis scariosis, pedicellis brevibus apice articulatis, perianthio cylindrico rubro viridi vittato lobis lineari-oblongis tubo brevioribus, staminibus inclusis.

Stony hills near Dobaibah near Gambla, alt. 3,000 feet.

Folia pedalia deorsum 2 poll. lata, medio 3–4 lin. crassa. *Racemi* inferiores subpedales, pedicelli 3 lin. longi, bracteæ 1½–2 longæ. *Perianthium*, 12–13 lin. longum.

A very distinct species. It was brought home in a living state along with two other Aloes, which cannot be safely determined till they flower. One of them, so far as the leaves go, closely resembles the Socotran *Aloe Perryi*, Bot. Mag. t. 6596.

Littonia obscura, *Baker in Hook. Icon. ined.*—Near Cosair.

PALMÆ.

Phoenix dactylifera, *Linn.*—Cultivated about all the villages.

Hyphæne.—Two species, both wild, one with a branching trunk, which lay flat on the ground. No flowers or fruit were obtained, so that the species cannot be settled.

TYPHACEÆ.

Typha angustata, *Chaub. et Bory.*—In a stream at Chail-ba-Wazir, alt. 2,500 feet, associated with a *Sparganium* in a young state. Extends from India through Northern Africa and Southern Europe.

JUNCACEÆ.

Juncus acutus, *Linn.*—Stream near Sah, alt. 2,300 feet. Extends to Syria, North Africa, and Europe.

CYPERACEÆ.

Cyperus lævigatus, *Linn.*—Brackish pool at Ghafit, alt. 600 feet. Cosmopolitan.

Scirpus littoralis, *Schrad.*—Same station as the last. Extends from India to the South of France.

GRAMINEÆ.

Pennisetum cenchroides, *Pers.*—Hills at Sibeh, alt. 800 feet. Extends from India to the Canary Islands and Cape of Good Hope.

Sorghum vulgare, *Pers.*—Cultivated at Al Hawi, alt. 2,300 feet. Native name, "*Durrah.*"

Saccharum officinale, *Linn* —Cultivated at Al Katan, alt. 1,150 feet. Brought recently from India.

Erianthus Ravennæ, *P. Beauv.*—Near a spring at Sah, alt. 2,300 feet. Extends from India through the Mediterranean region.

Eleusine coracana, *Gaertn.*—Tokham, near Mokalla, cultivated as food for cattle. Native name, "*Dokhn.*"

Sporobolus spicatus, *Kunth.*—Chail-ba-Wazir, alt. 250 feet. Extends to east tropical Africa.

Æluropus lævis, *Trin.*—Ghafit and Chail-ba-Wazir, in brackish places. Extends from Beloochistan to France. It is very common in salty ground, especially near the sea.

Triticum vulgare, *Linn.*—Cultivated under the date palm. Native name, "*Burr.*"

FILICES.

Cheilanthes farinosa, *Kaulf.*—Hills at Khailah, alt. 3,000 feet. Cosmopolitan.

Pteris longifolia, *Linn.*—Banks of the irrigation channels at Alrail, alt. 2,000 feet. Cosmopolitan.

Adiantum Capillus-veneris, *Linn.*—Sides of the irrigation channels at Khailah and Tahiyeh, alt. 1,400–3,000 feet. Cosmopolitan.

Actiniopteris radiata, *Link.*—Hill near Dobaibah, alt. 4,000 feet. Extends to India and through tropical Africa.

CHARACEÆ.

Chara foetida, *A. Br.*—Brackish water at Ghafit, alt. 600 feet Cosmopolitan.

CCCCVIII.—DECADES KEWENSES.

PLANTARUM NOVARUM IN HERBARIO HORTI REGII CONSERVATARUM.

DECAS IX.

81. **Pittosporum resiniferum,** *Hemsl.* [Pittosporaceæ]; ramulis crassis glabris nigris, foliis primum albo-lanatis citissimo glabrescentibus supra nitidis subtus pallidioribus crassis coriaceis longe petiolatis obovato-oblongis vel oblanceolatis abrupte breviterque obtuse acuminatis deorsum attenuatis, costa distincta supra impressa elevata, venis primariis lateralibus numerosis ultimis minute reticulatis nigrescentibus, floribus ignotis, fructu magno compresso-ovoideo plus minusve acuminato pericarpio ruguloso crassissimo duro osseo cavernulis latis resiniferis instructo.

Habitat.—Philippine Islands, Benguet, N. Luzon, *S. Vidal*, 1136. Also a specimen communicated by *Mr. E. M. Holmes*, Curator of the Pharmaceutical Society's Museum.

Folia cum petiolo 4–8 poll. longa. *Fructus* 1¼–1½ poll. longus circiter 10 lineas latus, pericarpio circiter 2 lineas crasso.

82. **Vitis (Eucissus) glossopetala,** *Baker* [Ampelideæ]; fruticosa, sarmentosa, ramulis glabris, cirris elongatis simplicibus, foliis magnis simplicibus cordato-ovatis cuspidatis denticulatis glabris, floribus in paniculam amplam ramis divaricatis multifloris corymbosis dispositis, calyce parvo pubescenti ore truncato, petalis 4 lingulatis primum calyptratim conniventibus demum solutis, staminibus petalis paulo brevioribus, stylo elongato.

Habitat.—North Madagascar, *Baron*, 6095, 6478; *Humblot*, 237.

Folia interdum pedalia et ultra. *Petala*, 3 lin. longa.

Differs from the many African species placed in his section *Eucissus* by Planchon by its longer lingulate petals and oblong buds slightly constricted at the middle. The flowers in a dried state are pale brown. The fruit is unknown.

83. **Cynometra Lyallii,** *Baker* [Leguminosæ, Tribe Cynometreæ]; ramosissima, ramulis apice pubescentibus, foliolis 4–5 jugis parvis rigide coriaceis oblique oblongis obtusis emarginatis glabris, floribus in fasciculis lateralibus sessilibus aggregatis, bracteis ovatis coriaceis persistentibus, pedicellis elongatis pubescentibus, calycis tubo brevissimo, lobis oblongis reflexis, petalis oblanceolatis obtusis, staminibus petalis duplo longioribus, ovario oblongo sessili.

Habitat.—Between Tamatave and Antananarivo, Madagascar, *Baron*, 5983. Gathered previously by *Lyall*, 217; *Pervillé*, 440, and in the island of Nossibé by *Boivin*.

Folia 1½ poll. longa, foliolis 5–6 lin. longis. *Petala* 2 lin. longa.

Distinguished from *C. madagascariensis*, Baill., by its much fewer pairs of sub-quadrangular oblong leaflets. The pod is unknown.

84. **Dimorphandra megacarpa**, *Rolfe* [Leguminosæ]; arbor ex maximis sylvæ (*Burchell*) foliis bipinnatis pinnis circa 22–24-jugis, foliolis 50–60 jugis sessilibus confertissimis lineari-oblongis obtusissimis glabris supra nitidis subtus pallidioribus basi suboblique truncatis, venis circa 8-jugis prope marginem connexis, rachidibus crassis furfuraceo-puberulis basi verrucosis, floribus ignotis, leguminibus lignosis late falcatis obtusis compressis marginibus læviter incrassatis 16–18-spermis septis transversis subcoriaceis, seminibus transversis lineari-oblongis tetragonis v. subcompressis lateraliter concavis apice emarginata, testa lignosa nitida, cotyledonibus crassissimis, radicula brevi recta inclusa, plumula pinnata pinnis 7-jugis.

Habitat.—Brazil, on the right bank of the Rio Mojú, a little below Jaguary, *Burchell*, n. 9381; Pará, *E. S. Rand.*

Petiolus circa 2 ped. longus. *Petioluli* 6–8 poll. longi. *Foliola* 4–5 lin. longa. *Legumen* 10–12 poll. longum, 3¼–3½ poll. latum, 14 lin. crassum. *Semina* 1½–2 poll. longa.

This fine species was met with as long ago as 1829, by Burchell, who notes it as one of the finest trees in the forest, though he only obtained pods, which, judging from their condition, may have been fallen ones. Although larger than those of any species previously known, the pods are structurally identical, and as the very characteristic leaves are also those of *Dimorphandra* there can be no doubt about the genus, and the species is evidently allied to *D. parviflora*, Spruce. The seeds are separated by thin subcoriaceous transverse divisions, and, owing to pressure, tetragonous or even laterally compressed. Mr. Rand describes it as "An immense tree, of which the only specimen known in Parā is in front of my door, and, though it must be at least 50 years old, has never been known to flower until this year. The flowers are in round close heads, like some Acacias; diameter of the ball of flowers from ½ to 2 inches, borne on long erect yellow spikes; colour yellowish white. On account of the height of the tree, say over 100 feet, it was impossible to get perfect flowers to press. The tree has an erect branchless shaft for about 75 feet, then a large spreading globular head. It sheds its fine leaflets twice a year, remains bare for only a few days, and then covers itself with new foliage with wonderful rapidity."

85. **Dissotis cryptantha**, *Baker* [Melastomaceæ]; fruticosa, ramosissima, ramulis pilosis, foliis sessilibus lanceolatis triplinerviis utrinque dense pilosis, floribus paucis ad ramulorum apices aggregatis foliis reductis ascendentibus subocultis, calyce globoso dense piloso, dentibus magnis lanceolatis pilosis deciduis, petalis magnis orbicularibus pulchre violaceis, staminorum longiorum connectivo producto basi bicalcarato.

Habitat.—Nyassaland, *Buchanan*, 625 of 1891 collection.

Folia 1½–2 poll. longa. *Calycis* tubus 3 lin. longus et latus: lobi tubo æquilongi. *Antheræ* majores 6 lin. longæ.

A handsome species, with the shrubby habit and large dark violet flowers of one of the cultivated Pleromas.

86. **Galpinia**, *N. E. Brown* [Lythrariearum genus novum]. *Calycis tubus* campanulatus, 5–6 dentatus, persistens, dentes valvati, sinibus dentiformibus. *Petala* 5–6, fauci calycis inserta, lobis alternata, corrugata. *Stamina* 5–6, petalis opposita, infra medium tubi calycis inserta, filamentis exsertis; antheræ parvæ didymæ. *Ovarium* sessile, liberum, imperfecte 2-loculare; stylus elongatus, stigmate simplici; ovula ∞, placentæ hemisphæricæ basilari et septis adnatæ affixa, erecta,

anatropa. *Capsula* (immatura) calyce inclusa subcoriacea, imperfecte 2-locularis, polysperma. *Semina* matura non vidi, immatura angulata, erecta. Arbor parva. Folia opposita petiolata, epunctata. Flores parvi, in paniculas terminales dispositi.

G. transvaalica, *N. E. Brown;* arbor parva ramulis tetragonis, foliis breviter petiolatis oblongis obovatis vel elliptico-obovatis apice obtusis recurvis basi cuneatis vel cuneato-rotundatis coriaceis margine angustissime recurvis glabris costa infra apicem subtus glandulifera, paniculis terminalibus erectis compactis multifloris ramulis acute tetragonis glabris, bracteis paucis oblongo-obovatis vel obovatis obtusis glabris, costa subtus infra apicem glandulifera, pedicellis tetragonis glabris, calycis tubo glabro dentibus triangularibus acuminato-acutis erectis marginibus subincrassatis minute ciliatis, petalis brevissime unguiculatis lanceolatis subacutis undulato-corrugatis impunctatis glabris albis, staminibus longe exsertis filamentis filiformibus demum circinatis antheris parvis loculis reniformibus, ovario depresso stylo longe exserto filiformi.

Habitat.—Transvaal, French Bob's Hill, Barberton 2,600 feet, April, *Galpin,* 889.

Arbor 15 ped. alta. *Foliorum* petioli $1\frac{1}{2}$–2 lin. longi, laminæ $1\frac{1}{4}$–$2\frac{1}{2}$ poll. longæ, $\frac{3}{4}$–$1\frac{1}{3}$ poll. latæ. *Paniculæ* $2\frac{1}{2}$–3 poll. longæ (pedunculi $\frac{1}{2}$–$\frac{3}{4}$ poll. longi inclusi), $1\frac{1}{4}$–$1\frac{1}{2}$ poll. latæ. *Bracteæ* $\frac{1}{6}$–$\frac{1}{4}$ poll. longæ, 1–2 lin. latæ. *Pedicelli* $\frac{1}{10}$–$\frac{1}{8}$ poll. longi. *Calycis* tubus $\frac{1}{10}$ poll. longus, dentes 1 lin. longi. *Petala* $\frac{1}{4}$ poll. longa, $\frac{1}{10}$ poll. lata. *Stamina* 4–5 lin. longa. *Ovarium* $\frac{3}{4}$ lin. longum. *Stylus* 3–4 lin. longus.

This very distinct and interesting plant is with much pleasure dedicated to its discoverer, Mr. E. E. Galpin, of Queenstown, South Africa, to whom Kew is indebted for many interesting plants living and dried. Its position in the order is somewhat doubtful, but probably it should be placed in the neighbourhood of *Pemphis* and *Diplusodon.* From all the genera except *Crypteronia*, *Tetrataxis*, and *Heteropyxis* it differs in having all the stamens alternating with the calyx-teeth, but the two former differ in having no petals and a different inflorescence, besides other characters; *Heteropyxis*, which is rejected from the order by Koehne in his monograph of the *Lythrarieæ*, differs in having alternate leaves, imbricate calyx-lobes, and the stamens inserted with the petals at the top of the calyx-tube. The leaves and bracts of *Galpinia* are remarkable on account of the gland on the underside of the midrib, just below the apex, which I do not find present in any other member of the order. The leaves are usually rather thick and opaque, with no visible dots even under a lens, but here and there a leaf from some cause or other has dried thin and subtranslucent, and when held up to the light, and examined under a powerful lens, is seen to be densely and very minutely pellucid-dotted.

87. **Ipomœa (§Euipomœa) sindica,** *Stapf* [Convolvulaceæ]; annua multicaulis, caulibus prostratis gracilibus hispidis, foliis triangulari-hastatis 2–3-plo longioribus quam latis acutis vel acuminatis lobis basalibus divergentibus obtusis utrinque hirsutis vel supra glabriusculis sed etiam subtus tandem glabrescentibus petiolis hispidulis $\frac{1}{4}$–$\frac{2}{3}$ laminæ, aequantibus, cymis paucifloris sæpe ad flores 1–2 reductis in axillis foliorum brevissime pedunculatis, pedicellis brevibus vel brevissimis, bracteis brevibus lineari-subulatis vel linearibus hispidulis, sepalis lanceolatis hispidulis demum paulo accrescentibus atque basi dilatatis,

corolla infundibuliformi calyce vix duplo longiore leviter lateque 5-lobata extus et in apice loborum sparse minuteque pilosula, capsula globosa glabra, seminibus tenuiter griseo-velutinis.

Habitat.—North-west India.

Sinde, no precise locality, *Dr. Cooke's* collector; near Karrachi, *Stocks*, 41, pro parte Multan, *Edgeworth*, 5031; Sirhind, *T. Thomson*; Etawah, *Duthie*, 6432.

Caules prostrati ¾–2 ped. longi. *Folia* ¾–2½ poll. longa, basi 3 lin. ad 1¼ poll. lata. *Sepala* sub anthesi 2–2½, demum ad 3 lin. longa. *Corolla* 3–4½ lin. longa. Capsula 2½–3 lin. longa.

When Dr. *T. Cooke* lately communicated a few specimens of this plant he suggested that it might be a new species. By closer examination I was not only able to confirm his view, but I found also several other specimens belonging to this species in the Kew Herbarium. They had been sorted with *I. eriocarpa*, R. Br., which is indeed very similar, but easily distinguished by larger flowerheads, larger bracts, hairy capsules, and glabrous, densely foveolate seeds. *I. Stocksii*, C. B. Clarke (Fl. Brit. Ind. iv., p. 204, not of p. 207), which is still more nearly allied, has different leaves, and shaggy rather than velvety seeds.

88. **Strobilanthus (§Endopogon) reticulatus**, *Stapf* [Acanthaceæ]; caule breviter strigilloso, foliis ovatis acutis basi interdum subcordatis subintegris utrinque strigilloso-hirsutis nervis lateralibus utrinque 6–8 subtus cum venis prominentibus reticulatis, petiolo ⅓ laminæ æquanti anguste alato, spicis ovatis e foliorum superiorum axillis breviter pedunculatis, bracteis ovatis interioribus quidem extus glabris vel subglabris intus plus minusve villosis, calyce profunde diviso glabro dentibus lineari (subulatis tubo 3-plo longioribus albo-fimbriatis exceptis, corollæ tubo basi angustissimo supra calycem valde ampliato limbo brevi lobis rotundato-ovatis, staminibus 2, filamentis patule pilosis antheris faucem haud attingentibus staminodiis 2 minutis dentiformibus, ovulis 2 in utroque loculo.

India, Mahabaleshwar, *Dr. T. Cooke.*

Folia ad 3 poll. longa, ad 1½ poll. lata. *Spicæ* ¾ poll. longæ. *Bracteæ* ad ½ poll. longæ. *Calyx* 4 lin. longus, lobi 2½–3 lin. longi. *Corolla* 1 poll. longa, medio ¼ poll. lata.

S. reticulatus is a rather marked species, allied to *S. foliosus*, T. Anders. though not very closely.

89. **Alocasia Curtisi**, *N. E. Brown* [Aroideæ]; omnino glabra, foliorum petiolo quam lamina multo longiore, lamina peltata ovato-sagittata apice plus minusve abrupte cuspidata mucronata supra læte viridi vel metallico-viridi subtus purpurea lobis basalibus ad ⅕–¼ connatis ovatis vel oblongo-ovatis obtuse rotundatis sinu parabolico vel angusto sejunctis margine parum sinuato, costæ anticæ nervis utrinque 4–5, costarum posticarum nervis 3–4 exterioribus 2 interioribus omnibus subrectis, nervis pallide vel albido-viridibus costis pallidioribus et glandulis axillaribus viridibus, pedunculo quam petiolo breviore obtuse trigono, spathæ tubo ellipsoideo pallide viridi quam lamina oblongo-lanceolata acuta plana reflexa vel revoluta quadruplo breviore, spadice quam spatha breviore parte fertili quam appendice terete acuta rugulosa ochracea multo breviore, ovariis subquinque-cyclis globosis viridibus stigmatibus magnis 3–4 lobis albis, organis neutris ochraceis, floribus masculis albis.

Habitat.—Penang, *Curtis.*

Foliorum petioli 1½–2½ ped. longi, laminæ 9–19 poll. longæ, 6–11½ poll. latæ, lobis basalibus 4–6 poll. longis, 3½–5½ poll. latis. *Pedunculi* 9–18 poll. longi. *Spathæ tubus* 1–1¼ poll. longus, 8–10 lin. diam., lamina 4–5½ poll. longa 1¼–1½ poll. lata. *Spadix* 4–6 poll. longus, parte fœminea 5–6 lin. longa, neutra 5–8 lin. longa, mascula ½–¾ poll. longa, appendice 2½–4 poll. longa, 4 lin. crassa.

Described from living plants sent to Kew from Penang by Mr. C. Curtis. It is allied to *A. decipiens*, Schott.

90. **Pandanus Thurstoni**, *Wright* [Pandaneæ]; fruticosus, foliis linearibus acuminatis marginibus minute denticulatis costis integris, druparum capitibus circa 8 racemose dispositis, drupis sejunctis 5–6-angulatis, stigmate spinoso secedente, semine solitario.

Habitat.—Fiji, *Thurston.*

Folia 10–12 ped. longa, basi 6 poll. lata. *Racemus* 2 ped. longus. *Fructus* 8 poll. longus, 4 poll. latus. *Drupa* 1 poll. longa, 4 lin. lata. *Stigma* 6 lin. longum.

This species belongs to the section *Rychia*, and is allied to *P. furcatus*, from which it differs in having the leaves very minutely denticulate, and the heads of fruit racemosely arranged, not solitary. One of two or three undescribed species, discovered by Sir J. B. Thurston, Governor of Fiji.

CCCCIX.—MISCELLANEOUS NOTES.

Mr. Sidney Alfred Skan, lately in the employ of the Royal Gardens, has been appointed, on the results of a competitive examination before the Civil Service Commission, an assistant in the Royal Gardens, to date from the 16th August 1894.

Mr. William Lunt, in the employ of the Royal Gardens, has been appointed by the Secretary of State for the Colonies, Assistant Superintendent of the Royal Botanic Gardens, Trinidad. Mr. Lunt was also lately employed as botanical collector, attached to Mr. Theodore Bent's Expedition to the Hadramaut Valley, Southern Arabia.

ROYAL GARDENS, KEW.

BULLETIN
OF
MISCELLANEOUS INFORMATION.

No. 94.] OCTOBER. [1894.

CCCCX.—LATHYRUS FODDER.

(*Lathyrus sativus, L.*)

Recent legal proceedings have called attention to the use of the seeds of the Bitter Vetch (*Lathyrus sativus*) in this country as a food for horses. The plant is an annual, closely allied to the sweet pea of gardens. It is cultivated extensively in Southern Europe and eastward as far as the plains of India. In the latter country it is known as *Jarosse* or *Gesse.* In the Mediterranean region the dried peas or seeds are used as food, the pods are eaten green and the whole plant is cut for fodder. In India there are about half a million acres under this crop annually. In spite, however, of this extensive cultivation the seeds are well known to possess poisonous properties and their continued use by man and animals has led to injurious results. The subject is fully discussed in Dr. Watt's *Dictionary of the Economic Products of India,* Vol. iv., pp. 592–594. From this work the following extracts are taken :—

Food and Fodder. — As already stated, this pea is cultivated principally as a fodder, but being very cheap and easily grown it is considerably used as food by the poorer classes, largely so in times of scarcity. It is also used to a considerable extent to adulterate *dál* from which it can scarcely be distinguished. The following chemical composition is given by Church : water, 10·1 ; albuminoids, 31·9 ; starch and fibre, 53·9 ; oil, 0·9 ; ash, 3·2. The nutrient ratio is about 1 : 1·75, while the nutrient value is nearly 8·7.

A recent analysis by Astier has revealed the presence in the grain of a volatile liquid alkaloid, probably produced by some proteid ferment, which exhibits the toxic effects of the seeds, and the action of which is destroyed by heat. The evil effects of habitual consumption of the seeds have long been known, and though the subject is one which has been much discussed, there appears to be no doubt that continued use of this article of diet has a tendency to produce paralysis. In one district of Bengal alone, according to Irving, nearly 4 per cent. of the population suffered from its toxic effects in 1860. That observer went into the subject most extensively, and found that if used occasionally and in small quantity, the results were constipation, colic, or some other form of indigestion. But, on the other hand, if freely employed, and especially without admixture with other sorts of grain, he found palsy to be a frequent sequel. Dr. Irving's results further showed that ill-effects were more apt to occur in the rainy season, and that the great majority of sufferers were males, the proportion in the cases which came under his observation being 6·11 males to 0·59 females.

During the years from 1829 to 1834 the grain formed, by a series of accidents, the chief food of some of the eastern villages of Oudh, and, apparently, as a direct result many cases of sudden paralysis of the lower extremities ensued. The circumstances which gave rise to this condition, and the characteristic features of the disease were carefully described by Colonial Sleeman, from whose account the following may be quoted:—

"In 1829 the wheat and other spring crops in this and the surrounding villages were destroyed by a severe hail-storm; in 1830 they were deficient from the want of seasonable rains, and in 1831 they were destroyed by blight. During these three years the *kasári*, which, though not sown of itself, is left carelessly to grow among the wheat and other grain, and given in the green and dry state to cattle, remained uninjured, and thrived with great luxuriance. In 1831 they reaped a rich crop of it from the blighted wheat fields, and subsisted upon its grain during that and the following year, giving the stalks and leaves only to their cattle. In 1833 the sad effect of this food began to manifest themselves. The younger part of the population of this and the surrounding villages, from the age of 30 downwards, began to be deprived of the use of their limbs below the waist by paralytic strokes, in all cases sudden, but in some more severe than in others. About half the youth of this village of both sexes became affected during the years of 1833 and 1834; and many of them have lost the use of their lower limbs entirely, and are unable to move. The youth of the surrounding villages, in which *kasári*, from the same causes, formed the chief article of food during the years 1831 and 1832, have suffered in an equal degree. Since the year 1834 no new case has occurred, but no person once attacked had been found to recover the use of the limbs affected, and my tent was surrounded by great numbers of the youth in different stages of the disease, imploring my advice and assistance under this dreadful visitation. Some of them were very fine looking young men of good caste and respectable famalies, and all stated that their pains and infirmities were confined entirely to the joints below the waist. They described the attack as coming on suddenly, often while the person was asleep, and without any warning symptoms whatever, and stated that a greater proportion of the young men were attacked than of the young women. It is the prevailing opinion of the natives throughout the country, that both horses and bullocks which have been much fed upon *kasári* are liable to lose the use of their limbs, but if the poisonous qualities abound more in the grain than in the stalk or the leaves, man, who eats nothing but the grain, must be more liable to suffer from the use of this food than beasts, which eat it merely as they eat grass or hay."

Again, Lisboa, commenting on this disease writes:—"The subject was taken up by Dr. Kinloch Kirk in Upper Sind. A villager had brought him his wife, about 30 years old, who was suffering from paralysis of the lower extremities. When questioned as to what he thought the cause to be, the man replied, 'It is from *kasári*; we are 'very poor, and she was obliged to eat it for five months on end.'

Dr. Kirk hereupon instituted inquiries into the subject, which confirmed the statement; and he adds that, 'the natives know this *dál* 'is poison, but they eat it because it is cheap, thinking that they can 'stop in time to save themselves from its consequences.'"

This condition, which has lately received the name of "lathyrismus," has formed the subject of investigations by Dr. B. Suchard, by whom it has been found that the chief effect produced on the human subject, is upon the muscles of the lower extremities, especially on those below the knee. In horses, paralysis of the hinder extremities also takes place, but an affection of the larynx, resulting in asphyxia and death has been observed, a complication which has not been recorded in man. Cantarri, of Naples, has published a number of cases in which he has carefully observed the conditions after death. The muscles of the face, neck, and trunk were found not to be affected; those of the lower extremities, especially the abductors, were found to have undergone a fatty degeneration, the transverse striæ being diminished, and the ultimate fibres containing little drops of oil. No affection of the spinal cord was discovered.

Until lately it was extremely doubtful as to what could be the cause of this poisonous action of the pulse. Various ideas were entertained by different writers, some holding that the noxious properties were due to the large per-centage of albuminous material contained in the seed. The recent isolation of an alkaloid which possesses the toxic characters of the grain would seem, however, definitely to settle the point. The importance of this discovery lies in the fact that the alkaloid is volatile. It may not be present in properly cooked preparations of the grain, such as thin pressed cakes made at a high temperature. On the other hand, if made at low temperatures or imperfectly cooked, these cakes, or preparations, such as curries, *dál*, pasteballs, &c., in all probability retain sufficient of the principle to produce poisonous effects if eaten during a prolonged period.

It seems probable that the volatile property of the poison may afford an explanation of the apparent capriciousness of the effects of the pulse on persons who habitually consume it. In any case, it is highly desirable that experiments should be made for the purpose of definitely ascertaining the presence or otherwise of the alkaloid in the ordinary Lathyrus diet, *chapatis*, *dál*, curries, pasteballs, &c. consumed as food by the natives of India. Should it be possible, by simple increase of heat and greater care in cooking, to render this avowedly noxious food grain a wholesome and nutritious article of food, one of the cheapest and most easily obtainable pulses of India might take a much higher rank than it now holds, and consequently become much more widely utilised. As already stated, the effects of the pulse when given as a food to cattle are similar to those observed in man. Thus, from the following extract from Smith's *Veterinary Hygiene*, it would appear to have been used with deleterious results in Europe:—"The disease arising from the use of *Lathyrus sativus* (*kesári dál*) has been described by Messrs. Leather and Professors McCall and Williams as affecting horses in England and Scotland. The grain is brought home to this country as ballast, and its action on horses is to produce the most intense dyspnœa and roaring when put to work; the appetite is not affected, and when in the stable the animal appears in perfect health. Several fatal cases are reported by these observers, whose articles in the *Veterinary Journal* and *Veterinarian*, April 1885, and *Veterinarian*, November 1886, may be consulted with great advantage."

Don writes regarding its effects on other animals: "Swine fattened on this meal lose the use of their limbs, but grow very fat lying on the ground. Kine are reported to grow lean on it, but sheep not to be affected. Pigeons, especially when young, lose the power of walking by feeding on the seeds. Poultry will not readily touch it, but geese eat it without any apparent damage. In some parts of Switzerland cattle feed on the herb without any apparent harm."

Special opinions:—"I have seen many cases of paralysis while a Civil Surgeon in the Punjab, which the patients themselves and their family all believed to be due to the use of *khesari dál*, and I have seen the specimens of the seeds and of the bread made from them." (*Surgeon-Major C. W. Calthrop, M.D., Morar.*) "The occasional use of the *dál* does not bring on paraplegia, but many poor people are obliged to live almost entirely on it. They eat the green undressed plant, cook it, make *dál* of the seeds, and *chapáti* of the flour. It is people of this description that suffer from paralysis of the lower extremities." (*Bolly Chund Sen, Teacher of Medicine*).

CCCCXI.—MINOR INDUSTRIES IN JAMAICA AND BERMUDA.

At one time it was somewhat the fashion to decry the small or minor industries in our Colonies. They were, in fact, regarded as likely to be of little permanent benefit to the community. During the last few years, however, great changes have taken place in the economic conditions of many of our tropical possessions, and small industries have been more fully appreciated.

Jamaica.—The banana cultivation in Jamaica, a case in point, may be cited as a most striking and remarkable instance of how a comparatively "minor industry" may, under suitable encouragement, attain to the rank of a staple product. Twenty-five years ago the value of the bananas exported from Jamaica was practically nothing. People grew them for their own use but never thought of shipping them. In the year 1892–93 the value of the bananas exported from Jamaica reached over 400,000*l*. It exceeded that of either sugar, rum, coffee, or dye-woods. In this case a minor industry of a comparatively unpromising character has been called into existence, and so advanced in value as to overtop old industries carried on for more than a hundred years. Banana cultivation in Jamaica has been of benefit also to other industries. Underneath the shade of the banana trees numerous plants have been grown likely to increase in the future the exports of coffee, cocoa, oranges, and spices. Not only so, but "ready money" to the extent of nearly 200,000*l*. annually has been circulated amongst small cultivators, who are the chief banana-growers, and their material prosperity and consequently their purchasing power have been increased. Further, land everywhere has enhanced in value, and a larger demand has taken place for cattle, mules, and horses, which are raised on "pens" in the interior. Practically, therefore, all classes of the community have been benefited and the general resources of the Government for public works and other undertakings improved. The foundations of this prosperity in Jamaica were laid mainly by the enlightened efforts of two able Governors (Sir John Peter Grant and Sir Anthony Musgrave), both of whom laboured most consistently for this end for many years. They often had to encounter great opposition in the earlier stages of their measures, but the results have fully justified the soundness of their policy. It is satisfactory to find that in the island itself full credit is now given to these men. Indeed their greatest memorial is the new Jamaica, with its extended railways, its network of telegraph wires, and the renewed life and activity which have been called forth by their efforts. There is no more striking instance of the potential value of small industries than this one. The example of Jamaica may therefore encourage other Colonies, whose prosperity has been checked by economic changes, to strike out in new directions.

Bermuda.—The small Colony of the Bermudas or Somers Islands in the North Atlantic (about 600 miles from the coast of the United States) furnishes also an instance how much may be done with small industries.

Bermuda furnishes New York with a large portion of the "spring onions" and young potatoes consumed in that city. It also grows lily bulbs (*Lilium Harrisii*) for both the United States and Europe, and the value of these exported last year was over 21,000*l*. The best quality of arrowroot is obtained only from Bermuda. Altogether its small industries in 1893 furnished exports to the value of nearly 120,000*l*. These and other particulars are more fully set forth in the *Annual Report* published by the Colonial Office (Colonial Reports, No. 105), lately presented to Parliament. The following extract gives the exports:—The principal export to the United Kingdom in 1893 was arrowroot, valued at 989*l*. The principal exports to Canada were lily bulbs valued at 1,209*l*., and onions, 956*l*.; and to the United States lily bulbs valued at 21,050*l*., onions at 59,870*l*., potatoes 26,622*l*., specie 6,000*l*., and cut flowers 1,367*l*. The prices obtained for the crops in the season of 1893 were about the same as in the preceding year.

CCCCXII.—DECADES KEWENSES.

PLANTARUM NOVARUM IN HERBARIO HORTI REGII CONSERVATARUM.

DECAS X.

91. **Brassica griquensis**, *N. E. Brown* [Cruciferæ]; herbacea tota pilosa vel subhispida; foliis inferioribus petiolatis lyratis lobis lateralibus 2–4 ovatis vel deltoideis obtusis subintegris terminali majore oblongo vel elliptico-oblongo dentato obtuso superioribus sessilibus oblongis dentatis obtusis vel subacutis, pedicellis floribus æquilongis, sepalis oblongis obtusis, petalis anguste oblanceolatis, siliquis erectis scabris vel adpresse hispidis, stylo brevi.—*Sisymbrium Turczaninowi*, Szyszyl. Enum. Polypet. Rehmann., p. 106, nec Sonder.

Habitat.—South Africa: Griqualand West, near the Vaal River, *Burchell*, 1771; Orange Free State, *Holub*, *Rehmann*, 3483; Bechuanaland, Barolong Territory, *Holub*; Transvaal, Hallwater Salt Pan, *Holub*.

Planta 6–8 poll. alta. *Folia* ¾–3 poll. longa, ⅓–1 poll. lata. *Pedicelli* 2 lin. longi, in fructu 3–4 lin. longi. *Sepala* 1½ lin. longa. *Petala* 2½ lin. longa ¾ lin. lata. *Siliqua* 8–11 lin. longa, ¾ lin. crassa, stylo ¼–¾ lin. longo.

Allied to *Sinapis pendula*, E. Mey., but at once distinguishable by its much shorter, erect, and setose pods; it also appears to be a smaller plant. Szyszylowicz mistook it for a *Sisymbrium*, but the cotyledons are conduplicate.

92. **Garcinia Buchanani**, *Baker* [Guttiferæ]; ramulis glabris, foliis oblongo-lanceolatis rigide coriaceis glabris acutis basi cuneatis, floribus femineis sparsis lateralibus vel terminalibus, pedicellis brevibus clavatis plicatis ad vel supra basin bracteis parvis ovatis persistentibus suffultis, sepalis latis brevissimis, petalis parvis oblongis, ovario globoso glabro, stigmate magno peltato brevi integro.

Habitat.—Nyassaland, *Buchanan*, 183 of 1891 collection.

Folia 2--3 poll. longa, media 10–12 lin. lata. *Petala* 3 lin. longa. *Stamina* et *bacca* ignota.

Habit of *G. Mannii* and *G. punctata*, Oliver. In *G. Livingstonei*, T. Anders., from the same country, the leaves are thicker and obtuse, the pedicelslonger and more slender, and the stigma is 2-lobed.

93. **Polycardia centralis**, *Baker* [Celastrineæ]; fruticosa vel arborea, glabra, foliis petiolatis oblongis obtusis rigide coriaceis siccitate pallidis, florum fasciculis in foliorum medio ad costam impositis, pedicellis flore multo longioribus ad apicem incrassatis, calycis tubo campanulato lobis parvis ovatis obtusis, petalis ovatis obtusis calyce duplo longioribus, genitalibus petalis brevioribus.

Habitat.—North Madagascar, *Baron*, 6368.

Folia 3–5 poll. longa, medio 12–18 lin. lata. *Petala* 1½ lin. longa. *Fructus* adhuc ignotus.

This differs from the other species of this curious genus by bearing the cluster of flowers in the middle of the face of the leaf. In the original *P. phyllanthoides*, Lam., they are in an apical sinus; in *P. lateralis*, O. Hoffm. (=*P. Hildebrandtii*, Baillon), and *P. baroniana*, Oliv. in Hook. Ic. t. 2237, they are in a lateral sinus, and in *P. libera*, O. Hoffm., free.

94. **Piptadenia Buchanani**, *Baker* [Leguminosæ, tribus Adenanthereæ]; arborea inermis, ramulis apice pubescentibus, foliorum pinnis 18–20-jugis, foliolis multijugis parvis linearibus rigidis imbricatis, racemis subspicatis cylindricis breviter pedunculatis, calyce hirsuto tubo campanulato dentibus 5 parvis late ovatis, petalis linearibus pubescentibus calyce quadruplo longioribus, staminibus longe exsertis, ovario pedicellato hirsuto.

Habitat.—Nyassaland, *Buchanan*, 192 of 1891 collection.

Folia semipedalia, pinnis 1½–2 poll. foliolis 2 lin. longis. *Racemi* 4–6 poll. longi. *Calyx*, ½ lin. longus.

Nearly allied to the West African *P. africana*, Hook. fil., from which it differs by its longer hairy flowers and stalked hairy ovary.

95. **Neogœzia**, *Hemsl.* [Umbelliferarum - Smyrniearum genus novum].—*Calycis* dentes prominentes, colorati. *Petala* lata, integra. *Discus* depressus vel subconicus. *Fructus* didymus, cordiformis, a latere vix compressus, ad commissuram sulcatus; carpella fere teretia, basi

gibbosa, ob vittas superficiales striata; juga primaria fere obsoleta; vittæ ad valleculas 3, ad commissuram 4–6, omnes tenuissimæ: carpophorum integrum.—*Semen* subteres, profunde sulcatum.—*Herbæ* Mexicanæ glabræ, perennes vel biennes, scaposæ, radicibus fasciculato-tuberosis. *Folia* pinnatim dissecta, omnia radicalia. *Umbellæ* simplices, in scapo gracili solitariæ, pedicellis filiformibus. *Involucri* bracteæ numerosæ, lineares. *Flores* polygami vel unisexuales; sepala purpurascentes?; petala flava vel citrina.

Neogœzia minor, *Hemsl.*; undique glaberrima, radicis tuberibus parvis clavatis, foliis petiolatis, petiolis usque ad apicem vaginantibus, crassiusculis pinnatis segmentis sessilibus confertissimis deorsum sese obtegentibus circumscriptione late ovatis alte paucilobatis lobis acutis, involucri bracteis angustissimis pedicellis dimidio brevioribus, calycis dentibus acutis, petalis late obovatis brevissime acuminatis vix inflexis.

Habitat.—Mountains above Oaxaca, Mexico, *C. G. Pringle*, July and August 1894.

Planta circiter 9 poll. alta. Folia 3-pollicaria. *Pedicelli* vix pollicares.

Through the courtesy of Mr. J. N. Rose, Assistant Botanist in the United States Department of Agriculture at Washington, we are able to establish this very distinct and elegant genus of Mexican Umbelliferæ. Two species were collected by Hartweg upwards of fifty years ago, but only flowering specimens were obtained. Since then, so far as our knowledge goes, no other collector has met with any member of this genus until this year; and now Mr. C. G. Pringle has discovered, in the mountains above Oaxaca, what we have described above as a third species. His specimens include almost ripe fruit, thus affording material for founding the genus. Hartweg's two species were provisionally published under the genus *Oreomyrrhis*, and are here transferred to *Neogœzia*:—

Neogœzia gracilipes, *Hemsl.* (Oreomyrrhis? gracilipes, Hemsl. *Diagr. Pl. Nov.* pars. 1. p. 16 et in *Biol. Centr. Amer., Bot.* i. p. 567. t. 33. et t. 34, figg. 6–8).

Neogœzia planipetala, *Hemsl.* (Oreomyrrhis? planipetala, Hemsl., *Diagr. Pl. Nov.* pars. 1. p. 16, et in *Biol. Centr. Amer., Bot.* i. p. 568. t. 34).

Dedicated to Dr. Edmond Goeze, Inspector of the Botanic Garden at Greifswald, Pomerania, and formerly a fellow-student of the writer at Kew. The affinity of the genus is not obvious, as it is one of the very few genera outside of the *Heterosciadieæ*, having simple umbels. In this character it agrees with *Oreomyrrhis*, in which two of the species were provisionally placed; but, as suggested by Mr. Rose, the characters of the fruit are rather those of the *Smyrnieæ*, and similar to those of the American genus *Arracacia*.

96. **Ursinia saxatilis,** *N. E. Brown* [Compositæ-Arctotideæ]; suffruticosa procumbens ramoso-cæspitosa, foliis ad apicem ramulorum confertis apice trifidis vel pinnatis, segmentis 3–5 tereto-linearibus mucronato-acutis glabris punctatis, pedunculis quam folia multo longioribus glabris 1–3 bracteatis monocephalis, bracteis tereto-linearibus, involucro late campanulato bracteis subquinqueseriatis glabris exterioribus line-

aribus intermediis ovato-lanceolatis interioribus oblongis apice rotundatis membranaceis albo-marginatis cæteris brunneis, ligulis lanceolato-linearibus luteis subtus cupreis glandulosis, floribus disci luteis glandulosis, achæniis tereto-angulatis pallidis basi pilis longis cinctis, pappi paleis orbiculato-obovatis emarginatis albis.

Habitat.—Transvaal, among rocks, summit of Saddleback Mountain near Barberton, 5,000 ft., *Galpin*, 945; *Thorncroft*, 113; *Wood*, 4165.

Folia ⅓–1 poll. longa, segmentis 1–3 lin. longis, ⅓ lin. latis. *Pedunculus* 2–4 poll. longus. *Capitulum* ¾ poll. diam. *Ligulæ* ⅓ poll. longæ, ¾ lin. latæ.

Allied to *U. apiculata*, DC., and *U. montana*, DC., but very distinct in its leaves and involucre.

97. **Helichrysum reflexum**, *N. E. Brown* [Compositæ-Gnaphalieæ]; suffruticosa ramosissima, ramulis gracilibus incano-tomentosis densissime foliatis, foliis reflexis sessilibus linearibus mucronulatis incano-tomentosis marginibus revolutis apice uncinato-apiculatis, capitulis terminalibus solitariis 150–160-floris, involucri bracteis 6–7-seriatis exterioribus gradatim brevioribus ovatis acutis pallide brunneis interioribus linearibus acutis argenteis nitidis quam flores plus duplo longioribus, receptaculo brevissime fimbrillifero, pappi setis subpaucis tenuissimis minutissime scaberulis, corolla quinquedentata glabra, ovario glabro.

Habitat.—Transvaal, among rocks, summit of Saddleback Mountain. Barberton, 5,000 ft., May, *Galpin*, 947.

Ramuli 1–4 poll. longi. *Folia* 2–3 lin. longa, ⅓–½ lin. lata. *Involucrum* 5 lin. longum, bracteis exterioribus 1–2 lin. longis, 1–1¼ lin. latis, interioribus 4½–5 lin. longis ½–⅔ lin. latis. *Corolla* ⅛ poll longa.

This species belongs to the group with toothed prominences on the receptacle between the flowers, and is at once distinguished from all other species by the reflexed linear leaves with which the branches are densely covered; the tomentum is close-pressed and felted. Probably the silvery inner involucral bracts are more or less radiating in the living state although on the specimen before me only three or four out of between 30 and 40 heads show evidence of this, nearly all of them have campanulate involucres. Of the described species it seems to me more nearly allied to *H. Newii*, Oliver and Hiern, than to any other I have seen.

98. **Cyphia tortilis**, *N. E. Brown* [Campanulaceæ-Cyphieæ]; tuberosa, caule volubili glabro, foliis alternis petiolatis glabris inferioribus spathulato-obovatis vel oblanceolatis obtusis vel subacutis basi cuneato-acutis crenato-denticulatis superioribus lanceolatis vel lineari-lanceolatis utrinque acutis crenato-denticulatis supremis integris, floribus axillaribus solitariis pedicellatis, pedicellis supra medium minute bibracteatis glabris, calycis tubo late obconico patelliformi lobis elongato-deltoideis acutis quam corolla quadruplo brevioribus glabris, petalis linearibus acutis vel subacutis apice recurvis duobus liberis tribus connatis basi gibbosis lilacinis intus barbatis, staminibus quam corolla multo brevioribus hirtis.

Habitat.—South Africa, locality unknown.

Foliorum petioli, 1–6 lin. longi, laminæ ⅓–1¼ poll. longæ, 1–6 lin. latæ. *Pedicelli* 4–5 lin. longi. *Calycis tubus* ½ lin. longus, 1⅓ lin. latus, lobi ¾–1 lin. longi. *Petala* 5 lin. longa. *Stamina* 3 lin. longa.

Described from plants cultivated in the Royal Gardens, Kew, that were received from Professor MacOwan, F.L.S., of Cape Town, who states that it is one of the species known as "Barroes." The succulent tubers are eaten after being roasted in the ashes of the fires made by travellers when outspanned, but have little to recommend them to an epicure. This species is nearly allied to *C. sylvatica*, Eckl., which is known as the "Bosch Barroe," but is distinguished by its leaves, and broad, almost saucer-shaped, calyx tube.

99. **Gymnostachyum decurrens,** *Stapf* [Acanthaceae]; herba basi parce ramosa ramis brevibus foliisque congestis solo subadpressis, foliis ovatis basi abrupte contractis secundum petiolum late decurrentibus subobtusis obscure crenulatis utrinque 4–6–nerviis crassiusculis nervis subtus pilosulis exceptis glabris supra albido-variegatis, spicis gracilibus multifloris secundis in panicula e basi pauciramosa terminali dispositis vel solitariis ut flores subdistichis minute patuleque glanduloso-pubescentibus, bracteis bracteolisque lineari-subulatis calyce multo brevioribus, calycis segmentis lanceolato-linearibus, postico breviore excepto subæqualibus, corollæ tubo calyce duplo longiore superne leviter ampliato albo violaceo-lineato, limbo bilabiato, labio superiore brevissime bilobo albo inferiore indiviso apice trilobulato basi bigibboso gibbis albis violaceo-punctatis exceptis violaceo, filamentis inferne pilosulis, antheris basi mucronatis dorso medio affixis, stylo sparse pilosulo, capsula rhachi adpressa quadrangulari-cylindrica, seminibus 9–30 in utroque loculo.

Habitat.—Tahan River, Pahang. Raised at Kew from seeds sent by *Mr. H. N. Ridley.*

Foliorum lamina 2–4 poll. longa, 2–3 poll. lata; petiolus ½–2 poll. longus. *Spicæ* ad 8 poll. longæ. *Calyx* 2–2½ lin. longus. *Corolla* 7–8 lin. longa. *Capsula* ¾ poll. longa.

This species has the habit of *G. febrifugum*, Benth., a plant hitherto known only from Mangalore in the Deccan Peninsula; but the flowers are much smaller, solitary (not fascicled), and arranged in two lateral rows. The decurrent slowly tapering portion of the lamina of the leaves is broader, and reaches the base of the petiole. It is generally distinctly wavy. The colour of the leaves is a dull green with a broad whitish portion along the very dark purplish midrib. The whole inflorescence is densely clothed with a minute glandular pubescence. The rhachis is dark violet or almost black, from which the white flowers, tinged with violet, show well up. *Gymnostachyum decurrens* is also related, probably more closely, to *G. leptostachyum*, Nees, from Tavoy, and to two Philippine species, *G. cumingianum*, and *G. affine*, both described by Nees, and to a Javanese species which was collected by Horsfield and distributed under the erroneous name of *G. leptostachyum*. The last also has decurrent leaves.

100. **Hypoxis floccosa,** *Baker.* [Amaryllideæ—Hypoxideæ]; cormo parvo oblongo, foliis radicalibus 5–6 linearibus pilis brevibus patentibus mollibus ubique vestitis, pedunculo 1–2-floro foliis breviore, bracteis parvis linearibus, pedicellis pilosis flore longioribus, ovario clavato piloso, perianthii segmentis parvis oblongo-lanceolatis exterioribus dorso viridibus pilosis, staminibus perianthio distincte brevioribus.

Habitat.—Cape Colony, hills near Swellendam, alt. 5,000 feet, *Bolus* 7469.

Folia 2–3 poll. longa, 1 lin. lata. *Perianthii* segmenta 2 lin. longa.
Allied to the widely-spread Cape, Tropical African, and Mascarene *H. angustifolia*, Lam.

CCCCXIII.—MADAGASCAR PIASSAVA.

(*Dictyosperma fibrosum*, Wright.)

For nearly twenty years a fibre closely resembling Brazilian piassava (described in *Kew Bulletin*, 1889, pp. 237–242) has been obtained from the island of Madagascar. It was moderately long, of a rich brown colour, and evidently obtained from the stem of a palm as ordinary piassava. The quantity produced was never very large, and in the early stages of the enterprise the fibre was shipped in a very rough, uncombed state. Latterly the quality has much improved, and during the period when this class of fibre commanded specially high prices the shipments were probably remunerative. Owing, however, to the discovery of West African piassava or "bass fibre" obtained from *Raphia vinifera* (described in *Kew Bulletin* 1891, pp. 1–5), the prices obtained for Madagascar piassava have apparently fallen almost as low as the cost of production, hence little of it has appeared lately in the London market. For the first specimen of Madagascar piassava, now in the Kew Museum (No. ii.) we are indebted to Messrs. J. Puddy & Co., of Mincing Lane. This was received in 1890. At that time the plant yielding it was not known. The more common palms of Madagascar such as species of *Hyphæne*, *Dypsis*, *Raphia* and *Bismarckia*, were believed not to yield this fibre. Hence it was inferred that there existed in the island a palm not yet described. This eventually proved to be the case. Through the efforts of Messrs. Proctor Brothers, of East India Avenue, E.C., Kew obtained in 1890 specimens of the complete plant known locally as *Vonitra*, with stem and leaves showing exactly the manner in which the fibre was produced. Each plant had a slender stem about 5 feet high and 2½ inches in diam. This was surmounted by a crown of graceful pinnate leaves 5–6 feet long. The whole stem, to the base, was thickly invested by a dense mass of fibres formed from the inner sheaths and the edges of the petioles. The individual fibres were finer and more flexible than Brazilian piassava and also slightly shorter; in other respects they resembled it very closely. As to the commercial position of the fibre, Messrs. Ide and Christie are good enough to inform us: "Of late, Madagascar piassava has been well combed, straight, and clean, and in this state it is worth from 30*l*. to 37*l*. per ton; but as the quantities sent home, even at these rates, are small, we are led to conclude the preparation as now done is costly." The shipments are made from Tamatave and some of the ports to the south. In September 1894, Madagascar piassava was reported to be "in demand," and the price had risen to 46*l*. per ton. Fresh seeds were obtained from Messrs. Proctor Brothers, and from these numerous plants, now about 2 feet in height, have been raised at Kew. They are nearest to *Dictyosperma album*, a well-known ornamental palm from Mauritius and Bourbon, but are easily distinguished both from this and other species. Many of the plants raised at Kew have been distributed to botanical establishments in the Colonies. Very soon the species will probably be well represented under cultivation.

As a new species, the following description of this palm has been prepared from such material as is now available. No flowers have yet been received.

Dictyosperma fibrosum, *C. H. Wright;* arbor, caule erecto fibris ex petiolis obsoletis vestito, foliis juvenilibus bifidis adultis æqualiter pinnatis, petiolis elongatis supra leviter concavis subtus convexis (*i.e.*, sectione transversali lunata) leviter furfuraceis, foliolis lanceolatis acutis basi contractis glabris, nerviis centralibus prominentibus lateralibus 3–4 minus conspicuis transversalibus paucis conjunctis, floribus ignotis, fructu subgloboso pericarpio fibroso stigmate terminali, semine embryone subbasilari, albumine ruminato.

Folia 5 ped. longa; *petiolus* 2 ped. longus; *foliola* 1½ ped. longa, 1 poll. lata. *Fructus* 8 lin. diam.

Habitat: Madagascar. *Nom. vulg.:* Vonitra.

This species differs from *D. album*, H. Wendl., in having the trunk covered with a dense mass of brownish fibres, about 18 inches long, which furnish the "Madagascar Piassava" of commerce. Specimens of this from Messrs. Proctor Brothers are deposited in the Museum of the Royal Gardens, Kew. The lateral nerves of the leaflets are also more conspicuous than in *D. album*, and the fruit is subglobose.

CCCCXIV.—THREE NEW SPECIES OF TRECULIA.

Under the name of Affon-tree some leafy branches and a large ripe fruit of a species of *Treculia* (Artocarpeæ) have recently been sent to Kew from Yoruba by Mr. A. Millson. The fruit is exceedingly like that of *T. africana*, but the leaves are so different in form and texture that, although flowering conceptacles are not present on the specimens, there can be no doubt that it is distinct from that species. It has therefore been described together with two other new species contained in the Kew Herbarium. It does not appear to have been clearly pointed out in the generic descriptions that the flowering bracts are truly confluent for a greater or lesser part of their length, the tips or only the peltate scales which terminate them being free. The original species of the genus, *T. africana*, was founded upon a fruit from Senegambia, but the leaves of it were undescribed; yet there is very little doubt that the plant identified with it, and figured in the Botanical Magazine, t. 5986, as *T. africana*, is the true plant, since it is one that has a very wide range in tropical Africa, its seeds being used as food by the natives. In this species, and it is probably the case in some of the others, the male conceptacles sometimes bear a few perfect female flowers, and the female conceptacles bear numerous imperfect male flowers, which have 2–3 stamens that do not grow out of the perianth, and a rudimentary ovary. The following is a key to the species at present known:—

Flowering bracts terminated by a circular peltate scale.
  Leaves coriaceous.
    Leaves 3–15 in. long, flowering-bracts free for half their length - - - - - *africana.*
    Leaves 2–4½ in. long, flowering-bracts confluent to the apex under the peltate scale - *madagascarica.*
  Leaves rather thin, parchment-like in texture *affona.*

Flowering bracts without a terminal peltate scale.
  Conceptacles spherical, perianth-lobes rounded or subtruncate - - - - - *acuminata.*
  Conceptacles obovoid or ellipsoidal, perianth-lobes lanceolate acute - - - *obovoidea.*

Treculia madagascarica, *N. E. Brown*; arbor ramulis apice puberulis exceptis glabra, foliis breviter petiolatis oblongis apice breviter obtuseque cuspidatis basi late cuneatis vel subrotundatis subobliquis coriaceis marginibus vix sinuatis, venis primariis utrinque 8–10, amento florifero masculo ellipsoideo vel subgloboso, bracteis usque ad apicem concretis squamis peltatis glabris ciliatis coronatis, perianthio campanulato oblique subtruncato et breviter denticulato, staminibus 2–3.

Habitat.—Central Madagascar, *Baron* 3252.

Foliorum petioli ⅛-½ poll. longi; *laminæ* 2-4½ poll. longæ, 1¼-2 poll. latæ. *Amentum floriferum* ⅝–⅞ poll. longum, ½–¾ poll. crassum.

This species has the coriaceous leaves of *T. africana*, but of smaller size, and is readily distinguished from that plant by having the flowering bracts confluent up to their apex under the peltate scale, which terminates them; in *T. africana* they are confluent only for ⅓–½ their length.

Treculia affona, *N. E. Brown*; arbor glabra, foliis breviter petiolatis lanceolatis breviter et obtuse acuminatis pergamentaceis basi cuneatis acutis vel subobtusis vix obliquis marginibus leviter sinuatis venis primariis utrinque 9–13, stipulis ovato-lanceolatis acuminatis, amento fructifero magno globoso, bracteis apice squamis peltatis puberulis ciliatis deciduis coronatis, nuculis oblique ovoideis.

Habitat.—Niger Territory, Yoruba, *Millson.*

Foliorum petioli ⅛–⅓ poll. longi; *laminæ* 2½–7½ poll. longæ; 1–3 poll. latæ. *Amentum fructiferum* 12 poll. diam. *Nuculæ* 4–5 lin. longæ, 2½–3 lin. crassæ.

Known as the "Affon-tree," and the seeds are used for food in the same way as those of *T. africana.* The fruits are placed in heaps and fermented; the seeds are afterwards gathered, ground into a paste and cooked by frying in palm oil. Although the fruits are regarded as poisonous to horses, sheep and goats they are, according to Mr. Millson, the favourite food of elephants.

Treculia acuminata, *Baillon*, Adansonia xi., p. 292.

When Dr. Baillon described this plant he had only seen the male inflorescence, but the Kew specimens have female conceptacles. These, like those of the male, are quite globose, and about ¼-inch in diameter, with well protruded bifid styles. The bracts at the base of the conceptacles are closely appressed to them, elliptic obtuse, puberulous. The floral bracts are pubescent and without a peltate scale at their apex, and are different in the two sexes: those of the male conceptacles are confluent nearly to the apex, or about ⅘ths of their length, the very short, free tips being all globose or obovoid clavate; those of the female conceptacles are free for half their length, and are of two forms; some being trigonous, fusiform, acute, the others being very much stouter, clavate, and obtuse. The somewhat echinulate fruiting receptacle is probably small, since an immature specimen measures only ¾-inch in diameter, as is noted in Bentham and Hooker, Genera Plantarum III., p. 375.

Habitat.—Gaboon, Mount John, River Kongui, *Mann*, 1804.

Treculia obovoidea, *N. E. Brown*; arbor 30-pedalis ramulis apice puberulis exceptis glabra, foliis breviter petiolatis oblongis vel obovato-oblongis apice longe lineari-cuspidatis obtusis basi cuneatis acutis vel subobtusis pergamentaceis venis primariis utrinque 8–10, amento florifero masculo obovoideo vel ellipsoideo, bracteis basalibus sublaxis subdistantibus ovatis acutis puberulis ciliatis, bracteis floriferis apice brevissime globoso-clavatis pubescentibus, perianthio tubuloso apice 4-lobato lobis lanceolatis acutis ciliatis, staminibus plerumque 3.

Habitat.—Old Calabar, *Mann* 2303; *Thomson* 104.

Foliorum petioli, 2–3½ lin. longi; *laminæ* 4–7 poll. longæ, 1–2¾ poll. latæ. *Amentum floriferum* (immaturum), ½–⅝ poll. longum, ⅓ poll. crassum. *Perianthium* 1 lin. longum.

This species is very similar to *T. acuminata*, Baill., in general appearance, but the leaves of that species are obtuse and emarginate or subcordate at the base, whilst in this species they are usually acute at the base, or, if obtuse, are simply rounded and neither emarginate nor subcordate. The inflorescence also is pear-shaped or ellipsoidal, not globose, and evidently much larger, as the measurements given above are from the largest inflorescences on the specimens, which are evidently immature as the stamens have only grown to about ⅔rds the length of the perianth. This has lanceolate acute lobes, whilst in *T. acuminata* the perianth lobes are rounded or subtruncate.

CCCCXV.—NEW ORCHIDS: DECADE 10.

91. **Pleurothallis pernambucensis**, *Rolfe*; caule primario repenti secondario subnullo, foliis confertis late ellipticis v. orbiculari-oblongis obtusis carnosis rigidis supra carinatis, spatha elliptico-oblonga obtusa compressa, racemis brevibus 5–6-floris, bracteis tubulosis apice triangulari-ovatis subacutis, sepalo postico oblongo-lanceolato subobtuso concavo lateralibus connatis elliptico-oblongis obtusis, petalis late obovato-oblongis obtusissimis uninerviis, labello late pandurato obtuso trinervio ecalloso, columna brevi.

HAB.—Brazil, prov. Pernambuco.

Folia 8–10 lin. longa, 5–7 lin. lata. *Spathæ* 2½–3 lin. longæ. *Racemi* ½ poll. longi. *Bracteæ* 1½ lin. longæ. *Sepala* 3 lin. longa. *Petala* ¾ lin. longa. *Labellum* 1½ lin. longum. *Columna* 1½ lin. longa.

A distinct little species belonging to the section *Apodæ prorepentes*, and allied to the West Indian *P. testæfolia*, Lindl. The flowers are very pale yellowish green, stained and densely speckled with light rosy purple. It was found growing in a clump of *Cattleya labiata*, introduced from Pernambuco, in the Nursery of Messrs. W. L. Lewis & Co., Chase Side, Southgate, N., and flowered during June last.

92. **Dendrobium subclausum**, *Rolfe*; pseudobulbis erectis teretibus gracilibus apice flexuosis verrucoso-scabridulis, foliis lineari-oblongis subobtusis racemis brevibus paucifloris, bracteis oblongo-lanceolatis acutis apice carinatis valde concavis, floribus aurantiacis, sepalo postico lanceolato-ovato subobtuso lateralibus triangulo-ovatis subcarinatis basi cum columnæ pede in mentum elongato-conicum extensis, petalis ovato-lanceolatis subobtusis, labello unguiculato angusto supra medium paullo

dilatato valde concavo apice subito inflexo triplicato cucullato margine fimbriato columna approximato ore subclauso, columna brevissima.

Hab.—Moluccas.

Pseudobulbi 1–1½ ped. longi, 1½–2 lin. lati. *Folia* ¾–1¼ poll. longa, 1½–2 lin. lata. *Bracteæ* 2–3½ lin. longæ. *Pedicelli* 11 lin. longi. *Sepalum* posticum 5 lin. longum, 2 lin. latum; lateralia 9 lin. longa, 3 lin. lata. *Petala* 4 lin. longa, 1½ lin. lata. *Labellum* 8 lin. longum, 2 lin. latum. *Mentum* 7 lin. longum. *Columna* 1 lin. longa.

This is a brilliantly coloured and remarkable species, which was introduced by Messrs. James Veitch and Sons, of Chelsea, and flowered in their establishment in July last. Technically it belongs to the section *Pedilonum*, though there is no species with which it can be compared. The pseudobulbs are very slender, and, owing to the facility with which young growths are produced on stems of the previous year, assume a branching habit. The flowers are three-quarters of an inch long, and, as well as the pedicels, of a brilliant cinnabar-orange or vermilion shade. The lip is very remarkable, being suddenly infolded near the apex in an acute angle, and plaited round the denticulate margin, which lies so close to the anther and sides of the column as to nearly close the flower, in allusion to which the name is given.

93. **Megaclinium pusillum,** *Rolfe*; pseudobulbis ovoideo-oblongis tetragonis diphyllis, foliis lineari-oblongis obtusis coriaceis, scapis brevibus vaginis paucis membranaceis tectis, rachi brevi compressa obscure crenulata inæquilaterali, bracteis ovatis subacutis patentibus, sepalo postico lineari subobtuso recurvo lateralibus late ovatis apice attenuatis falcato-incurvis facie velutinis, petalis angustissimis recurvis, labello basi lato apice angusto obtuso recurvo ciliato, columna brevi marginata edentata.

Hab.—East Tropical Africa.

Pseudobulbi 1–1¼ poll. longi. *Folia* 3 poll. longa, ½ poll. lata. *Scapi* 4 poll. alti. *Rachis* 4 lin. lata. *Bracteæ* 1½ lin. longæ. *Sepalum* posticum 3½ lin. longum; lateralia, 1½ lin. longa. *Petala* 2½ lin. longa. *Labellum* 1 lin. longum.

This species is the next ally of *Megaclinium melanorhachis*, Rchb. f. (*Gard. Chron.*, 1875, ii., p. 162), and, like it, has the rachis unequal-sided, the bracts and flowers being arranged near the lower margin. That, however, has a broader rachis, more numerous smaller flowers, and the dorsal sepal much broader but only half as long. The present species has a light green rachis marbled with purple brown, and the flowers similar but rather darker in colour. It flowered at Glasnevin in June last, under the care of Mr. F. W. Moore, A.L.S.

94. **Megaclinium triste,** *Rolfe*; pseudobulbis oblongis trigonis obtusangulis diphyllis, foliis lineari-oblongis obtusis coriaceis, scapis elongatis vaginis tubulosis ad 11 tectis, rachi subcompressa crassa carnosa obtusangula obscure crenulata scabridula, bracteis approximatis late ovatis obtusis concavis patentibus, floribus velutinis, sepalo postico lineari-subulato acuto recurvo lateralibus late falcato-ovatis subobtusis, petalis subulatis falcato-recurvis, labello basi lato pectinato apice angusto obtuso recurvo integro, columna brevi marginata dentibus brevibus.

Hab.—Not known.

Pseudobulbi 1½–2 poll. longi. *Folia* 3–5 poll. longa, ¾–1 poll. lata. *Scapi* 1¼ ped. alti. *Rachis* 5 lin. lata, 3 lin. crassa. *Bracteæ* 4 lin.

longæ, 4 lin. latæ. *Sepalum* posticum 5 lin. longum ; lateralia 3 lin. lata. *Petala* 4 lin. longa. *Labellum* 1 lin. longum.

A very distinct species, allied to *Megaclinium leucorachis*, Rolfe (*Kew Bulletin*, 1891, p. 198), having a similar thickened rachis with rounded obscurely crenulate margins, which, however, is blackish in colour and the flowers similar, instead of being white and yellow respectively. And the details of structure in the two are naturally quite different. In the present one the flowers are velvety, and the petals quite black, except at their tips, where a few light green markings occur. The sepals and petals are also barred and spotted with black on a light green ground, though the markings greatly preponderate over the ground colour. Its origin is not exactly known, but it is believed to have been received with a few African orchids sent by M. Godefroy Lebeuf, of Argenteuil, France. It flowered at Kew in August last.

95. **Cyrtopera flexuosa**, *Rolfe;* pseudobulbis confertis ovoideo-oblongis circa 4-phyllis, foliis elongato-linearibus acutis flaccidis, scapis elongatis tenuibus subflexuosis, bracteis ovatis acutis parvis, sepalis patentibus oblongis obtusis lateralibus cum pede columnæ in mentum conicum productis, petalis patentibus lineari-oblongis obtusis basi attenuatis, labello recurvo integro oblongo obtuso disco velutino, columna brevi clavata angulata.

HAB.—Kilimanjaro, E. Trop. Africa, *Smith*.

Pseudobulbi ½–¾ poll longi. *Folia* 5–11 poll. longa, 2–3 lin. lata. *Scapi* 9–12 poll. longi. *Bracteæ* ¼ lin. longæ. *Pedicelli* 7–8 lin. longi. *Sepala* 4 lin. longa, 1½ lin. lata. *Petala* 4 lin. longa, 1¼ lin. lata. *Labellum* 4 lin. longum, 2 lin. latum. *Columna* 2 lin. longa. *Mentum* 2 lin. longum.

A very distinct species which flowered in the Kew collection during the present year, from May to August. It differs from most of its allies in having aerial pseudobulbs and evergreen almost grass-like leaves. The scapes are somewhat flexuose, taking a new direction at each node, in allusion to which the name is given. The flowers are white, with a few small light purple spots on the petals, and the centre of the lip light yellow, with numerous deeper purple spots on either side, which are almost suffused into an irregular band. The face of the column is also lined with light purple, and its foot suffused with the same colour and a little yellowish green.

96. **Stanhopea Randii**, *Rolfe ;* pseudobulbis tetragono-ovoideis corrugatis parvis, foliis petiolatis elliptico-lanceolatis breviter acuminatis plicatis, scapis pendulis basi paucivaginatis 2–4-floris, bracteis elliptico-lanceolatis acutis convoluto-concavis imbricatis, ovariis pubescentibus, sepalis elliptico-oblongis acutis valde concavis lateralibus paullo latioribus leviter carinatis, petalis lanceolato-oblongis acutis planis, labello subintegro, hypochilio ovali-oblongo utrinque basi cornu erecto brevi instructo lateribus bicarinatis ore parvo transverse lineari-oblongo, mesochilio truncato margine acuto, epichilio triangulo acuto plano, columna incurva apice bidentata alis rotundatis.

HAB.—Brazil : River Purus, Upper Amazon Region.

Pseudobulbi saltem 1 poll. longi. *Folia* 8½ poll. longa, v. ultra, 2½ poll. lata. *Scapi* circa 2 poll. longi. *Bracteæ* 1¼ poll. longæ. *Pedicelli* 2½ poll. longi. *Sepala* 1¾ poll. longa, posticum 9 lin. latum, lateralia 11 lin. lata. *Petala* 1½ poll. longa, 7–8 lin. lata. *Labellum* 1½ poll. longum. *Columna* 1½ poll. longa.

This very distinct species was sent in alcohol, by E. S. Rand, Esq., Pará, Brazil, who describes it as a very beautiful species, unlike any he has ever seen, and the only Brazilian one he knows which grows above the Amazonian delta. It is obviously allied to *S. eburnea*, Lindl., though the flowers are far smaller, and the fleshy part of the lip, formed by the united hypochil and mesochil, only half as long as in that species. The mouth is also reduced to a small transverse opening, half a line long by two lines broad, while the two horns are erect and situated at the extreme base. The flowers are described as ivory-white, with a faint shade of yellow on the lip, and very sweet-scented, with a perfume like "winter-green." The contraction of the mouth of the hypochil is evidently correlated in some way with the insect which fertilises the flower, as the cavity inside is crowded with small papillæ, which Crueger has shown, in the case of an allied species, to be attractive to bumble bees, though here it is exceptionally well protected against marauders by the contracted mouth and the two horns at the sides. It would be very interesting to ascertain what insect fertilises it.

97. **Stanhopea nigripes**, *Rolfe*; pseudobulbis tetragono-ovoideis corrugatis, foliis petiolatis elliptico-lanceolatis acutis plicatis, scapis pendulis basi vaginatis 3–4–floris, bracteis oblongo-lanceolatis acutis convoluto-concavis, sepalis elliptico-oblongis acutis concavis lateralibus paullo latioribus, petalis lineari-oblongis acutis undulatis revolutis, labello trilobo, hypochilio oblongo lateribus carinatis ore suborbiculari canali angusto, mesochilio bicornuto, epichilio ovato-orbiculari subobtuso integro, columna incurva apice bidentata alis amplis rotundatis.

HAB.—Not known.

Pseudobulbi 1½–2 poll. longi, 1–1½ poll. lati. *Folia* 10 poll. longa, 4 poll. lata. *Scapi* 3–4 poll. longi. *Bracteæ* 1¾ poll. longæ. *Pedicelli* 2½ poll. longi. *Sepala* 3 poll. longa, posticum 1½ poll. latum, lateralia 1¾ poll. lata. *Petala* 2½ poll. longa, 9 lin. lata. *Labellum* 2½ poll. longum. *Columna* 2½ poll. longa.

A very handsome species allied to *S. Wardii*, Lodd., and *S. Ruckeri*, Lindl., though markedly different in the details of the lip. The sepals and petals are yellow, with many small purple blotches, and the lip and column whitish yellow, with many small purple spots on the base, the epichil, the middle of the column, and lower part of the wings. The hypochil bears a large very dark purple-black eye-like spot on either side, while the interior of the cavity is almost entirely of the same colour, in allusion to which the name is given. *S. florida*, Rchb. f., is also a near ally, but, besides differences in the lip, the ground colour of the flower is described as white. It was purchased at a sale in 1892, beyond which nothing is known of its origin. It flowered at Kew in August 1893 and again a year later.

98. **Catasetum punctatum**, *Rolfe*; pseudobulbis fusiformi-oblongis, 3–4-phyllis, foliis elliptico- v. obovato-lanceolatis acutis v. apiculatis basi attenuatis, scapis erectis circa 11-floris, bracteis triangulo-ovatis acutis, sepalis patentibus elliptico-oblongis acutis concavis, petalis suberectis eliptico-oblongis subobtusis lateribus reflexis, labello galeato transverse constricto apice obtuso lobis lateralibus rotundatis obtusissimis ciliato-fimbriatis intermedio brevissimo late truncato obscure apiculato integro carnoso intus medio utrinque transverse lamellato, columna

clavata rostrata antennis medio approximatis apice æqualiter divergentibus.

Hab.—Brazil.

Pseudobulbi 2½–6 poll. longi. *Folia* 4–10 poll. longa, 2–3 poll. lata. *Scapi* 6–8 poll. longi. *Bracteæ* 4–5 lin. longæ. *Pedicelli* 9–10 lin. longi. *Sepala* 14–15 lin. longa, 7–8 lin. lata. *Petala* 12–13 lin. longa, 7–8 lin. lata. *Labellum* 9 lin. longum, 8 lin. latum. *Columna* 11 lin. longa.

A species introduced by Messrs. Linden, L'Horticulture Internationale, Brussels, and flowered in their establishment in July last. It belongs to the section *Eucatasetum*, and is allied to *C. albovirens*. The sepals and petals are very pale yellowish-green with numerous small light-brown spots, those on the petals being somewhat transversely arranged. The lip is yellow, very pale at the apex, and the transverse callus inside of a bright orange. The flowers are powerfully aromatic. At present the female flowers are unknown.

99. **Polycycnis Lehmanni**, *Rolfe*; pseudobulbis cæspitosis oblongis compressis paullo sulcatis monophyllis, foliis breviter petiolatis lanceolato-oblongis acutis, scapo pendulo multifloro rachi pubescenti, bracteis lanceolatis acuminatis, sepalis reflexis lanceolatis acutis, petalis lineari-lanceolatis acuminatis basi angustissimis, labello breviter unguiculato trilobo basi utrinque minute auriculato, lobis lateralibus subfalcato-oblongis apice subito contractis angustatis acutis basi callo adnatis, intermedio dilatato fere trilobo apice acuto, disco longe piloso, callo carnoso lineari-oblongo obtuso scabridulo-puberulo, columna graciliter arcuata apice alata.

Hab.—New Granada, *Lehmann*.

Pseudobulbi ¾–1¼ poll. longi, ½–¾ poll. lati. *Folia* 7 poll. longa, 1½ poll. lata; *petiolus* ½ poll. longus. *Scapus* 9 poll. longus. *Bracteæ* 4–5 lin. longæ. *Pedicelli* 8–11 lin. longi. *Sepala* 9 lin. longa, 2 lin. lata. *Petala* 10 lin. longa, 1½ lin. lata. *Labellum* 8½ lin. longum, 6 lin. longum; lobi laterales 4 lin. longi, 1½ lin. lati; callus 1½ lin. longus. *Columna* 9 lin. longa.

A rather pretty species which flowered in the collection of Sir Trevor Lawrence, Bart., Burford, Dorking, in August last. It has flowers nearly as large as in *P. barbata*, Rchb. f., but the side lobes are narrowed into a falcate acute apex, not obtuse or nearly truncate, as in *P. barbata*. Two other species of the genus are known only from descriptions, which, however, do not agree with the present one. The sepals and petals are light tawny-brown spotted with purple, the lip rather whiter with darker purple spots, the disc covered with long white hairs, and the apex of the column deep purple. It is the sixth described species of the genus.

100. **Vanda roeblingiana**, *Rolfe*; caule erecto subelongato, foliis recurvis lineari-oblongis oblique truncatis v. subbilobis carinatis conduplicatis, pedunculis 2–6-floris, bracteis ovato-oblongis obtusis, sepalis obovato-oblongis obtusis, petalis similibus, labello trilobo lobis lateralibus erectis quadratis retusis intermedio patenti plano basi hastato pubescenti deinde angustato apice subito dilatato utrinque dolabrato denticulato, calcare conico brevi, columna clavata.

Hab.—Malay Archipelago.

Caules 1 ped. longi. *Folia* 5–6 poll. longa, 1–1¼ poll. lata. *Pedunculus* 6 poll. longus. *Bracteæ* 2½ lin. longæ. *Pedicelli* 1¼ poll. longi. *Sepala* 10–11 lin. longa, 4 lin. lata. *Petala* 9 lin. longa, 3½ lin. lata. *Labellum* 10 lin. longum; lobi laterales 2½ lin. longi, 2 lin. lati; intermedius 9 lin. latus; calcar 2 lin. longum. *Columna* 5 lin. longa.

This strikingly distinct species was introduced by Messrs. Hugh Low & Co., of Clapton, from the vicinity of Singapore, and flowered in their establishment in July last. It is allied to *V. limbata*, Blume, but differs from every other in the remarkable shape of the lip, which is suddenly dilated at the apex into a pair of halbert-shaped lobes. The rest of the front lobe is very narrow, pubescent, and with hastate base. The sepals and petals are deep brown irregularly veined with yellowish green, most distinctly on the petals. The side lobes of the lip are white streaked with purple, and the front lobe brown with irregular radiating yellow veins. It is dedicated by request to the Hon. Charles G. Roebling, of Trenton, New Jersey, U.S.A. At present only a single plant is known, which bears eight spikes of flowers. There is no species with which it can be usefully compared, though its affinity is probably in the neighbourhood of *V. brunnea*, Rchb. f.

CCCCXVI.—ST. VINCENT BOTANIC STATION.

A somewhat full account of the history of the interesting Botanic Garden at St. Vincent was given in the *Kew Bulletin*, 1892, pp. 92–104 (with plate). The steps taken to start the present Station were described in *Kew Bulletin*, 1891, pp. 140–145. A note on the working of the Station was given in *Kew Bulletin*, 1894, p. 80. In a Report on St. Vincent issued by the Colonial Office (*Colonial Reports*, No. 108) the following information is supplied by the Administrator respecting the current work of the Station:—

Agriculture.—Under this heading reference must be made to the Botanic Station, which shows great progress since its re-establishment in 1890, when a portion of the grounds of the Old Botanic Garden of St. Vincent, which was the first of its kind in the West Indies, and started in 1765, but allowed in 1849 to go out of cultivation, was again turned into use. It is most interesting to note that the present Botanic Station is of great assistance to the Colony, and of growing importance to the planters, who are able to study the various experiments conducted for the benefit not only of the planter class, but also of the peasant proprietors. During the last year grants of coffee and cocoa plants have been made to the purchasers of Crown Lands, to encourage the growth and produce of those valuable trees, which should ere long add considerably to the revenue of the Colony and the prosperity of the planters themselves.

The authorities of Kew Gardens give every assistance, not only in giving advice, but also in furnishing valuable seeds and plants, and in the hands of the indefatigable and energetic Curator, Mr. H. Powell, the future success and development of the Botanic Station is assured, and it is to be hoped that the minor industries of fruit products throughout the Island will receive greater attention than has lately been the case. During the fall of the year a small Meteorological Station was formed in the gardens, and reliable observations were recorded for the last quarter. Though sugar is still the chief staple product, the cultivation of arrowroot is largely on the increase, and, after the introduction of a better class of machinery, since 1890, the quality of arrowroot has much improved. Much greater attention has lately been paid to the cultivation of cocoa, coffee, and spices, and several new plantations are now commencing to bear, with a hopeful promise for the future. The frequent visits of the Curator to different localities, and his practical lessons on planting and pruning, given on the spot, are productive of much good.

CCCCXVII.—BHABUR GRASS.

(*Ischæmum angustifolium*, Hackel.)

A note on Bhabur grass (with a plate) was published in the *Kew Bulletin*, 1888, pp. 157–160. This grass is a native of India, and it is remarkable as possessing the technical qualities, similar to Esparto, necessary for paper manufacture. Its merits were first brought into notice by Dr. George King, C.I.E., F.R.S., Superintendent of the Royal Botanic Gardens, Calcutta, in 1877–78. Since that time the grass has become more largely used in India, and at the present time it affords the chief raw material for paper-making in the neighbourhood of Calcutta and other parts of British India. The following additional information respecting it is given in the recently published *Annual Report of the Royal Botanic Garden*, Calcutta, for the year 1893–94, p. 2:—

"Seed of the grass, known variously as *bhabar*, *babui*, and *sabai*, was issued to a few applicants outside of India. This grass (of which the botanical name is *Ischæmum angustifolium*) first attracted my notice as a possible raw material for paper twenty-five years ago, while I was in the Forest Department in the North-west Provinces. It is very common in the Siwalik range, and in the Bhabar forests of the Gharwal and Kumaon Himalaya. Samples of it, sent home by me in 1873 to a paper-maker in Scotland, were favourably reported upon; and again in 1877 a sample sent by me to the India Office, having been submitted to the late Mr. Routledge, of the Ford Paper Mills (then a leading authority on paper-making), was declared by him to be little inferior to *Esparto* as a raw material for paper. A year or two subsequently to this it was discovered, by the help of Mr. J. S. Gamble, of the Forest Department, that this grass is common in the forests of Chota Nagpur. Samples of it were accordingly sent by me to the Bally Paper Mill, then the only one near Calcutta. The sample was approved of at Bally, and since then the use of this grass has so increased that it now forms the chief raw material of an industry which, in this country, is yet probably only in its infancy. As seed of Bhabar grass is now being applied for from abroad, it is possible that, before long, it may be cultivated in other tropical countries."

CCCCXVIII.—BULBOUS VIOLET IN THE HIMALAYAS.

A very interesting addition to the Flora of British India is due to Mr. J. H. Lace, to whose zeal the Herbarium at Kew owes many valuable contributions from Baluchistan and the North-Western Himalaya. It consists in the discovery of a curious little bulbous violet in Bussahir at an elevation of about 10,500 feet. It is not a new species, and it has even been collected before within the limits of the Flora of British India. It was, however, mixed up by Dr. T. Thomson in the Flora of British India with another species, and so completely lost sight of that it has since been described twice under different names. The specimens referred to above as gathered within the limits of the Flora of British India were collected by Griffith, probably in Bhootan, and by Sir Joseph Hooker, near Lachen, in Sikkim, at 12,000 feet. Griffith's locality is not ascertainable with certainty, as the labels belonging to his specimens have evidently been mixed. They were distributed, under No. 231, as *Viola Griffithii*, Hook. f. & Thoms. (which name was never published), partly with the indication "East Bengal," and partly "East Himalaya." The latter is probably the correct one, and no doubt the violet in question is the plant which he mentions as *Viola pusilla* in his *Private Journals*, p. 292, and as "*Viola sp.—Parvula, floribus parvis, albis, in grassy spots*" in his *Itinerary Notes*, p. 194, No. 1,064, both passages referring to a place above Chupcha, in Western Bhootan, at an elevation of 8,800 feet.

When Dr. Thomson described his *Viola Hookeri* for the *Flora of British India*, he drew the description up partly from these specimens, but partly also from specimens which belong to a totally different plant, although he was not unaware of there being perhaps two species among what he called *Viola Hookeri*. As this second species was represented by much more complete material, his description naturally agrees better with it, and it seems, therefore, more expedient to retain the name *Viola Hookeri* for this plant, which is represented in the Kew Herbarium from the following localities:—1. Bhootan, Rydang *in ripis* (Griffith, No. 236 of the Catalogue, and No. 233 of the Kew Distribution; *see* also his *Itinerary Notes*, p. 116, and his *Private Journals*, p. 277). 2. Sikkim, Lachen, in woods at 8,000 feet, Aug. 3, 1849, and at 10,000 feet, July 9, 1849 (J. D. Hooker). 3. Sikkim, Khursiong, at 7,000 feet (C. B. Clarke, 36,562), and Tongloo, at 9,000 feet (C. B. Clarke, 35,734). The other species comprised by Dr. Thomson under *Viola Hookeri* would thus have no name if it had not been described since from other localities. It was collected by Przewalski, in 1873, and by Potanin, in 1885, in the province of Kansu, and described by Maximowicz as *Viola bulbosa*, in *Bull. Acad. Imp. Sc. St. Petersburg*, xxiii., p. 334 (1877), and in *Fl. Tangut.*, p. 77, t. 13. Other specimens of what I consider to be the same species were collected by the Abbé Delavay on Mt. Hee-chan-men, near Lang-kang, in Yun-nan, at an altitude of 10,000 feet. These were originally referred to *Viola Hookeri* by Franchet (in *Bull. Soc. Bot. France*, xxxii. (1885), p. 5), and by Hemsley (in Forbes and Hemsley, *Ind. Fl. Sinensis*, p. 43), but described as a new species, as *Viola tuberifera*, by Franchet (in *Bull. Soc. Bot. France*, xxxiii. (1886), p. 410, and in *Plantae Delavayanæ*, p. 70, t. 19). A comparison of Griffith and Hooker's specimens with Przewalski's, which constitute the type of *Viola bulbosa*, with Potanin's and Delavay's, leave no doubt on my mind as to their identity. The Bussahir plant, gathered by Lace, differs from the specimens thus referred to *Viola bulbosa* in no essential character, though the specimens are mostly stouter, with larger bulbs and a shorter suprabulbous axis. Their leaves are also more obtuse than those of the Kansu specimens, but one of these exhibits exactly the same foliage.

Przewalski and Potanin's specimens were collected "in *pratis alpinis humidis rupibusque totius Kansu.*" Delavay describes the habitat of the Yun-nan violet as "*in pascius pinguibus et humidis,*" and Lace indicates the plants as growing "in short turf amongst the grass." The elevations at which *Viola bulbosa* was found are: about 10,500 feet in Bussahir, 12,000 feet in Sikkim, 8,800 (?) feet in Bhootan, 10,000 feet in Yun-nan, and 9,000–10,000 feet in Kansu.

The peculiar mode of vegetative reproduction by bulbs, and their structure, have been very accurately described by Maximowicz. The bulbs, which sometimes attain the size of a pea, consist of a short and fleshy axial portion, and of 4–8 scales, which are very fleshy at the base, but scarious near the margin. The scales are rotundate, obtuse, or shortly acuminate, and the upper ones sometimes have short scarious stipules attached to them. They are manifestly the modified basal portions of very much reduced leaves. Above the bulb the axis continues, forming a short or more or less elongated and slender stem (½–2 in. long), which is terminated by a rosette of leaves, whilst the flowers spring from the axils of one or two of the lowermost leaves. The bulbscales, as well as some of the leaves following next to them, produce from their axils buds which are more or less flattened from the back and ovoid. Maximowicz calls them "bulbilli," although they hardly deserve this name. They grow into slender stolons, which, apart from a few minute scales, are naked, and quite like the young stolons of other violets, as, for instance, *Viola uliginosa.* They are 1–2 in. long in the Kansu and Sikkim specimens. In the Bussahir and in the Yun-nan specimens they are apparently absent, but they may be found on a closer examination as more or less developed buds, concealed by the bulbscales or the leaf sheaths. Maximowicz suggests that these stolons become finally transformed at their apices into the bulbs which emit a leaf and flower-bearing axis in the next season. Although there are no specimens exhibiting these bulbs in their stage of rest in the Kew Herbarium, the plants collected by Lace are very much in favour of this suggestion, as a portion of what I take to be a stolon is still attached to the bulbs in several cases. The rootlets necessary for the independent establishment of the young plant spring in great number from the base of the bulb and the axils of the bulbscales, and if the suprabulbous portion of the axis is much lengthened also from it.

The development of more or less fleshy rhizomes and of fleshy cataphylla on the rhizomes is not very rare in the genus *Viola*, but the transformation of the terminal bud of the stolons into a typical bulb is, as far as my knowledge extends, quite unique in the genus.

Viola bulbosa was compared by Maximowicz with *Viola Patrinii*, D.C., and, indeed, it seems to approach closer to it than to any other species of Central Asia or the Himalaya, in spite of its very peculiar innovation. True, the stigma of *Viola bulbosa* is almost exactly as in *Viola biflora*, which has also similar leaves, but a different mode of growth, being tri-axial (see Döll, *Rheinische Flora*, P. 647–8. The style is slightly geniculate above the base, then it becomes gradually thicker, being flattened at the back. The stigma itself has two very small rounded lateral wings, which, in combination with a slight depression in front, give it the peculiar shape of an easy chair with a very low back. Below this depression and above a very minute triangular hyaline lip there is the small stigmatic foramen. In *Viola Patrinii*, the wings are reduced to two angles, whilst the lip is enlarged so that the stigma appears triangular when seen from above. I add the description which would have to be inserted in the *Flora of British India* on p. 183 after *Viola Patrinii.*

Viola bulbosa, *Maxim.* in *Bull. Acad. Imp. Sc. St. Petersburg*, xxiii. (1877) p. 334; glabrous or more or less pilose, stem short from a bulb, stoloniferous, leaves orbicular-reniform, very obtuse or broadly ovate, base cordate, slightly crenate, petiole winged, stipules narrow, ciliate, or eciliate, adnate at the base, flowers white with red veins, sepals subacute, spur very short. *Maximowicz, Fl. Tang.*, p. 77, t. 13. V. Hookeri, *T. Thoms.* partly; V. tuberifera, *Franch.* in *Bull. Soc. Bot. France*, xxxiii. (1886), p. 410 and *Plant. Delavay.* p. 70, t. 19.

Temperate Himalaya, alt. 8,800 (?) to 12,000 feet, from Bussahir to Bhootan, Griffith, *J. D. Hooker, Lace.—Distrib.* Central Asia, South-west China.

Perennial bulb of the size of a pea or smaller, suprabulbous stem ½–2 in. slender. Leaves ½–1¼ in. broad, crenatures very broad and shallow; petiole ½–1½ in. long, slender. Flowers white, lower petal streaked with purple. Style narrowed downwards from the shortly-winged and minutely lipped stigma.

O. STAPF.

CCCCXIX.—MISCELLANEOUS NOTES.

India.—Dr. G. King has sent a further collection of some 250 sheets of new or rare plants, chiefly Malayan, and about 100 sheets of Mr. J. S. Gamble's fine Bamboo Herbarium.

Californian Plants.—Two important collections of dried plants from comparatively unexplored regions of California have lately been presented to the Herbarium; the one by Professor E. L. Greene, and the other by Professor F. V. Coville. The former consists largely of new species published by the donor; and the latter of the plants enumerated and described in Professor Coville's "*Report on the Botany of the* "*Expedition sent out in* 1891 *by the United States Department of* "*Agriculture to make a Biological Survey of the Region of Death* "*Valley, California.*" Apart from the novelties described, the report in question is an admirable and valuable contribution to botanical science, and Kew is fortunate in getting a set of the plants so ably discussed and dealt with by the author, who was also the collector.

Flora of the Tonga or Friendly Islands.—Mr. W. Botting Hemsley, F.R.S., has compiled an enumeration of all the vascular plants known to occur in this group of islands, and it has been published in the thirtieth volume of the *Journal of the Linnean Society*, together with full particulars of the general distribution of the species represented. This small flora is essentially Malayan in character, although more than a third of the species are peculiar to Polynesia; and there is scarcely any vestige of affinity with the Australian or New Zealand flora.

Indigofera disperma, *Linn.*—This was named and described as a species by Linnæus in the Appendix to the third volume of the 12th edition of the "Systema Vegetabilium," page 232 (1768). It is founded on a plant drawn by Ehret, which was published as table 55 in Trew's "Plantæ Selectæ" (1750–1773). The figure is an excellent one and evidently represents a mere form of *Indigofera tinctoria*, in which only two of the many ovule have matured. The species, however, seems to have passed unchallenged up to the present. It stands as a good one in De Candolle's *Prodromus* and the *Index Kewensis.* Our attention was drawn to it by receiving an application for seeds from the Director of the Botanic Garden of Buitenzorg. By Linnæus the locality is simply given "in Indiis." In the *Index Kewensis* it stands as "India Orientalis," but the name will be sought for in vain in Hooker's *Flora of British India.*

Mummy Pea.—A very curious pea, of which the Director obtained seeds from Messrs. Thomas Sutton, of Eastbourne (who stated that it had been brought from Egypt by the Hon. Charlotte Ellis), under the above name, has flowered at Kew this summer. It has fasciated cylindrical stems, nearly an inch in diameter, with a large number of peduncles springing from and near the apex, peduncles much longer than the stipules, bearing two or three flowers each, long petioles, three pairs of oblong sharply serrated leaflets, a white standard, dull reddish-purple wings, and a greenish-white keel. The seeds much resemble those of the wild *Pisum elatius* of the Mediterranean region. Similar fasciated forms of the pea are figured by Tabernæmontanus in his Herbal published in the year 1590 on page 495, and are described by Philip Miller in the eighth edition of his "Gardeners' Dictionary" (1771), under the name of "Pisum umbellatum, Rose or Crown Pea." The native country of *Pisum sativum* and *P. arvense* has never been satisfactorily ascertained. It is not unlikely that they may be both cultivated races derived from *P. elatius*, which extends in a wild state from France to Western Asia.

The name "Mummy Pea" is equally applied to the non-fasciated form. (See *Garden*, 1894, Vol. II., p. 118.)

Jamaica Walnut.—Concerning the paragraph on this subject, p. 138 of the current volume of the *Bulletin*, Dr. I. Urban, who has made a special study of the Flora of the West Indies, writes to the effect that there are valid differences between the fruits of *Juglans jamaicensis*, C.DC. and *J. insularis*, Griseb. He further expresses his conviction that in this instance, at least, Descourtilz's figure is an original and genuine one. We have not seen fruits of either the Portorico or Cuban Walnut: therefore we are not in a position to verify Dr. Urban's conclusions; but, as we stated before, judging from the leaves, we can find no character to separate them. Perhaps this notice may be the means of our obtaining more complete material. Mr. Fawcett, the Director of the Public Gardens of Jamaica, who is now in England, intends making a special search for the reputed Jamaica Walnut, which Dr. Urban thinks may still exist, as several other trees have recently been re-discovered, though they had not previously been collected since the time of Browne or Swartz.

The Sandalwood of Juan Fernandez.—The discovery and description of living specimens of a species of *Santalum* from this island was announced in the current volume of the *Bulletin*, p. 110. Since then, through the kindness of Prof. F. Philippi, Director of the Botanic Garden, Santiago, Chili, Kew has become the possessor of a specimen of his *S. fernandezianum*. It is only a branch bearing a few leaves, but it is evidently a true *Santalum*, and evidently distinct from all previously known species.

Hooker's Icones Plantarum.—The continuation of this important work is carried on by the trustees of the Bentham Fund for the Promotion of Botany, under the editorship of Professor D. Oliver, F.R.S. It consists of figures of a selection of novelties from the Kew Herbarium. Each volume contains 100 plates, from drawings by the late W. H. Fitch and Miss M. Smith, with descriptive letterpress, and is issued in four parts, at about quarterly intervals. The sale is entirely in the hands of Messrs. Dulau & Co., 37, Soho Square, London, W. The third series, consisting of vols. xi.–xx. of the entire work, is now offered at the reduced price of 5*l*. Three volumes of the fourth series have appeared; price 16*s*. per volume. Vol. xvii. contains ferns only; and xxi. and xxii. are entirely devoted to orchids. The others illustrate a great variety of curious and rare plants; the later volumes the novelties, more especially of recent explorations in China, Africa, and Borneo.

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OF

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CCCCXX.—TROPICAL FODDER GRASSES.

The selection of suitable grasses for cultivation in tropical countries is a matter of considerable importance. Few countries have completely solved the question. It is evident also that a good deal of time and energy is spent in the effort to introduce foreign grasses, when there are excellent indigenous grasses close at hand. It is proposed to draw attention to a few grasses that have attained to first rank for fodder purposes in the tropics, and to give particulars respecting the conditions under which they have been found to thrive It is well known that the same kinds of grasses do not succeed equally well in all localities. There are certain conditions and peculiarities of climate and soil to be considered; but there is no reason to doubt that if careful experiment is made suitable grasses can be found for cultivation in almost every tropical country. In some of our colonies it is well known that grass, even for valuable horses, is gathered day by day from waste places and jungles. Such fodder is not only poor in quality, but it is liable to be infected with disease from stray animals. Further, during seasons of drought, the fodder supply is likely to fail altogether. The selection and cultivation of grasses, with particular reference to their grazing qualities, or for the production of hay, should receive more attention, and it will doubtless become, before long, a regular branch of rural industry in the tropics, as it has been for so many years in temperate countries.

NATURAL HERBAGE.

In the tropics the difficulty in establishing grasses is caused by the usually rank growth of weeds and bushes. These soon overrun any cleared area, and they have to be continually eradicated, or the grass would be completely destroyed. The natural herbage in most tropical countries would, of itself, form excellent pasture for cattle and horses. There is hardly any part of the world entirely devoid of good grasses, and these should first of all receive attention. Where no suitable fodder grasses are available, then, under such exceptional circumstances, it would be well to introduce the useful "Guinea grass" and "Para grass" for cultivation on land suitable for the purpose. In countries like Ceylon and Jamaica, there are vast stretches of lands, known as "patanas" and "savannahs," where somewhat coarse grasses have established themselves almost to the exclusion of everything else. Even these grasses, although in a fresh state they may be distasteful to cattle, become, after being cut and partially dried, very acceptable food to them. Such grasses might also be largely utilised for silage purposes. Under cultivation, good pastures can, as a rule, be established by clearing the land of weeds and bushes, and encouraging the spontaneous growth of local grasses from seed carried from neighbouring areas. This is regularly done in Jamaica in regard to Guinea grass. During the first year or two the land requires to be carefully weeded, and if the soil is poor it should also receive a dressing of manure. After the grass has become thoroughly established an annual clearing after the rains is all that is required. It should, however, be understood that continuous feeding is injurious to the permanency of good pastures. The best grasses are thus destroyed, and rank growing ones gradually take their place. Close feeding for a time is advantageous, but the pasture should have time to recover before the animals are again placed upon it. Further, it is better to keep cattle on a portion of the pasture at one time, and not allow them to wander at will over a large area.

TREES IN PASTURES.

Thwaites recommended that in Ceylon trees should always be planted upon land laid out for permanent pasture. The trees would afford grateful shade to the cattle, and they would prevent the grass from being entirely dried up during seasons of drought. Trees would also add to the beauty of the country. Most extensive pastures dotted over with shade trees exist in Jamaica. Many trees, such as the Saman (*Calliandra Saman*), not only give excellent shade, but the pods are a most wholesome food for cattle. The commoner and more hardy sorts of mango might be planted for the same purpose, as also the Ramoon (*Trophis americana*), the leaves of which afford a very nutritious food for cattle in tropical America; the bread nut (*Brosimum Alicastrum*); the Jack tree (*Artocarpus integrifolia*); and the bastard cedar (*Guazuma tomentosa*). The leaves as well as the fruits of the last are much liked by cattle. This brief list of useful pasture trees might be considerably enlarged. It would be noticed that many of the trees mentioned belong to the natural order, *Urticaceæ*. As the plants belonging to this order are so widely distributed over tropical regions, each country could make its own selection of suitable pasture trees. The best tree of all is, undoubtedly, the Saman. (*Kew Reports*, 1878, p. 18, *et. seq.*)

GRASSES FOR DRY REGIONS.

Where the climate is moist and humid the selection of suitable grasses presents little difficulty. In countries subject to periods of prolonged droughts the circumstances are wholly different. The great want in such regions is the introduction of grasses that will maintain growth and vigour during many months when no rain falls. Grasses of this kind are to be found in the Bahama grass (*Cynodon Dactylon*), the Kangaroo grass of Australia (*Anthistiria australis*), and the Mitchell grass of Australia (*Astrebla triticoides*). These will stand periods of prolonged drought, and, in the case of the last, cattle are said to fatten on it, even when it is much dried up. In Jamaica, during severe droughts, cattle feed almost entirely on the underground stems of the

Bahama grass. In dry soil impregnated with salt there are several grasses known in India affording a considerable amount of forage. A variety of *Sporobolus arabicus*, Boiss. (S. pallidus, *Duth.*) known as *Kalusra*, is mentioned by Duthie as constituting the greater part of the grass vegetation of the *usar* tracks in the north-western provinces, and is always a sure indication of the presence of *reh* salts. Other grasses mentioned as more or less characteristic of saline soils are *Aristida depressa*, Retz. (more sandy parts): *Cynodon Dactylon*, Pers. (on less infected parts); *Chloris barbata*, Sw. (more sandy parts); *Tetropogon villosus*, Desf.; and *Diplachne fusca*, Beauv. (in moister parts).

ANNUAL FODDER GRASSES.

In dry regions not suitable for permanent pastures the Abyssinian Teff (*Eragrostis abyssinica*) might be grown during the occasional rains and made into hay. This grass will produce a heavy crop of hay in six weeks from the time of sowing. It is very nourishing, and cattle are very fond of it. There are other annual grasses that might be grown during the rains for fodder purposes. In Northern India green wheat is used as fodder, and where a large yield is desired within a short season, green oats are also used, as in St. Helena, for fodder purposes. The maize (*Zea Mays*) is often given as a green fodder, or dried and mixed with other green fodder. On sugar estates in the West Indies and elsewhere "cane tops" are largely used during crop time as fodder for working cattle, mules, &c. The tops are cut small, and sometimes mixed with molasses. They are regarded as most nourishing. In Mysore *Sorghum saccharatum* is regarded as an excellent fodder, and if cut before seeding it is well suited for cattle, especially milch cows—"their milk being enriched to an extraordinary degree by its use in small quantities." The United States Agricultural Department has declared that "the value of sorghum for feeding stock cannot be surpassed by another crop, as a greater amount of nutritious fodder can be obtained from it in a shorter time, within a given space, and more cheaply." The common sorghum (*Sorghum vulgare*), the *Juár* of India, is largely used as fodder, green or dry. It is often specially grown as a fodder crop, in which case it is sown earlier and more thickly than when cultivated for the grain.

A very valuable fodder grass belonging to this group is the Teosinte (*Euchlæna luxurians*). This yields very large crops in good land, and is regarded as one of the most prolific of annual grasses. Four good cuttings can be made in four months.

Most of these annual grasses, as also many coarse-growing perennial grasses, might be largely utilised by being preserved in the green state in silos. In South Africa silos, consisting merely of pits dug in the ground, have been found very useful in preserving fodder that would otherwise be lost, until the dry season. The cost of making silos is comparatively trifling, but it should be borne in mind that fodder preserved as hay is often more generally useful, and especially if made in good weather. Silos, on the other hand, offer a very ready and convenient means for preserving fodder during wet seasons, when it is impossible to make it into hay.

GRASS GROWING IN INDIA.

Voelcker[*] records an instance of the greatest care in grass growing in India, at Nadiad, in Gujarát (Bombay), where the cultivators do not use the village common land for their cattle. "Every one of their fields," he says, "is enclosed with a hedge, and then comes a headland of grass from 15 to 20 feet wide all round the field, and producing capital grass. There is a double object in this practice, for, as the fields are hedged, and have trees round them for supplying firewood and wood for implements, the people know quite well that crops will not grow when thus shaded, but that grass will. They obtain four or five cuttings of grass in the year as food for their cattle, and when the fields are empty the cattle are let in to graze on them. . . . Dúb grass (*Cynodon Dactylon*) as a crop for irrigation gives a great yield, and is about the only grass that keeps green in the hot weather. At Belgaum, fields are grown with grass; two cuttings are obtained yearly, and 6 annas is the sum paid for 100 lbs. of green grass. No seed is ever sown, only the grass that comes up naturally being used."

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[*] Report on the improvement of Indian Agriculture, London, 1893.

To supply grass to military cantonments in India regular grass farms have recently been established. These were started by Sir Herbert Macpherson at Allahabad in 1882, and since then have been extended largely.

Previous to the introduction of the grass farm system, the practice had been to send out "grass-cutters," whose duty it was to cut and collect grass for the troops from wherever they could. Owing to a full supply of grass being now obtainable by the "grass-cutters" from Government grass lands great saving has been experienced, and the horses are believed to be healthier owing to the grass no longer coming from unprotected and suspicious sources. The amount of grass grown at military stations in India has been so increased that it is now possible to supply not only the British troops, but even the native cavalry with it. The saving at Allahabad alone for the seven years 1882–89 was estimated at Rs. 91,158. The extent of the Allahabad grass farm is 3,558 acres.

Ensilage, or the preserving of green fodder, has been carried out at many places in India. The cost as between haymaking and that of silage is, however, unfavourable to the latter. One advantage of cutting an early crop of grass for silage is that there are many grasses, such as numerous species of *Panicum*, which seed in the rains; these may be secured as silage if rain continues, whereas the other grasses, being kept back somewhat, yield a good hay crop about October, when the rains are over. It may further be said in favour of silage that by means of it some grass which would otherwise have been altogether lost owing to the heavy rains is saved by being put into the silo. Voelcker concludes: "I differ entirely from the opinion of one of my predecessors to the effect that India is the great field for the development of silage. That it is the field for haymaking I am much more ready to think. With a sun and climate such as exist over the greater part of India, I cannot see how it could well be otherwise. Hay requires no making, for it makes itself. Silage, I repeat, will only be useful when by means of it can be saved what would otherwise be lost."

The following tropical grasses are selected as possessing special merits for fodder purposes. Amongst them are plants suitable for almost every condition found in tropical countries. The list has had the advantage of the revision of Sir Joseph Hooker, who is now working out the grasses of British India and who has suggested some emendations of the commonly accepted nomenclature.

Anthistiria australis, *R. Brown.*—The well-known "Kangaroo grass" of Australia, but widely distributed throughout Southern Asia and the whole of Africa. A perennial upright grass over 3 feet in height. It enjoys a wide reputation and is regarded as the most useful of the indigenous grasses of Eastern Australia, stock of all descriptions being remarkably fond of it. The roots are strong, and penetrate the soil to a great depth, so the plant remains green during the greater part of the summer. In the autumn the foliage turns brown, when, however, its nutritive qualities are said to be at the highest. If cut as soon as the flower stem appears it can be made into excellent hay. The most reliable way to propagate this grass is by division of the roots. It perfects very little seed (Turner).

Anthistiria avenacea, *F. v. Mueller.*—"Tall oat-grass" of New South Wales. A nutritious perennial pasture grass, often rising to a height of 4 to 5 feet. It grows generally in tussocks, and prefers rich soils, where its roots can penetrate deeply into the ground. It thus can withstand long spells of dry weather with impunity. It yields a large amount of bottom fodder, and is regarded by Bailey as "one of the most productive grasses of Australia." It possesses the advantage of seeding freely. Turner remarks "it might be profitably cultivated for ensilage, especially if it were cut before the flower stems become hard and cane-like."

Astrebla pectinata, *F. v. Mueller.*—Widely distributed in dry regions inland in North and East Australia. Closely allied to "Mitchell grass," but usually not so tall. A perennial desert grass, resisting drought, and sought with avidity by sheep, and very fattening to them and other pasture animals.. Seeding freely (Mueller).

Astrebla triticoides, *F. v. Mueller* (Danthonia triticoides, *Lindl.*).—The "Mitchell grass" of Australia. A very valuable perennial grass with glaucous green leaves. On rich soils it produces a great amount of rich herbage, of which stock of all kinds are remarkably fond. Cattle are said to fatten on this grass even when it is much dried up during periods of drought. If cut when about to flower it makes excellent hay. Turner "thoroughly recommends it for permanent pastures." The land should, however, be well drained.

Cynodon Dactylon, *Pers.*—A prostrate perennial grass with very narrow glaucous green leaves. It is widely distributed in all hot countries, and extends also into temperate regions. It passes under various names, such as "Bahama grass," "Bermuda grass," "Indian couch grass," "Doub," and "Doorva." It is an important grass for covering bare, barren land, and for making smooth, compact lawns. It resists extreme drought, and once established in cultivated land it is very difficult to eradicate. It is easily established by planting small portions of the rooting stems about 8 inches apart. If done at the beginning of the rainy season the ground will be completely covered in six weeks. It may also be propagated by seeds, which are now readily obtained in commerce. It should, however, never be planted except in places where it is required to remain permanently. When grown specially for fodder, in enclosed paddocks, it yields three or four crops in the year, and makes excellent hay. In very dry seasons in the West Indies animals exist almost entirely on the underground rhizomes of this grass.

The following note on the use of Bahama grass for making lawns in India is taken from Firminger's *Manual of Gardening for Bengal and Upper India* [Calcutta, 1874] p. 26 :—"The grass principally used for lawns in this country is that called Doob-grass (*Cynodon Dactylon*), a plant of trailing habit, not growing high, and when in vigorous growth of a soft dark green hue. It thrives where scarcely any other kind will, and delights in the edges of frequented highways. The spot it seems to like especially is where brick and lime rubbish has been thrown and trodden down hard. It will also grow in the poor soil beneath the shade of trees, where other grasses grow but scantily, if at all. When required for lawns a sufficient quantity can easily be collected from the roadside and waste places. The piece of ground intended for lawn should be well dug, and then made perfectly level and smooth. Drills should then be drawn over it a foot apart, in which little pieces of the roots should be planted out at the distance of half-a-foot from each other, and the ground afterwards watered occasionally, till the grass has become thoroughly established. In Bengal further watering will be unnecessary, but in the upper provinces irrigation during the hot season is indispensable, as otherwise the grass would soon become scorched up and perish.

"A more expeditious and very successful plan of laying down a lawn, sometimes adopted, is to pull up a quantity of grass by the roots, chop it tolerably fine, mix it well in a compost of mud of about the consistency of mortar, and spread this out thinly over the piece of ground where the lawn is required. In a few days the grass will spring up with great regularity over the plot."

Eragrostis abyssinica, *Link.*—A slender annual grass, known in Abyssinia as "Teff," "Ttheff," or "Thaff." It is indigenous to the higher lands, and is cultivated for the sake of its grain all over Abyssinia. There are several varities, some depending on the height of the plant, others on the colour. According to Richard, there are green, white, red, and purple Teffs. The grain crop requires four months to ripen. "In good years it returns 40 times the seed, and only 20 times in bad years." The flour of teff is very white, and produces bread of excellent quality. Seed of teff was obtained by Kew in 1886, and distributed to numerous establishments in India and the colonies (*Kew Bulletin*, 1887, January, pp. 2–6). The plant prefers light sandy soils, and adapts itself even to the most sandy ; it then produces slender wiry stems, and supports a large weight of ear. The grain is reported to make "an excellent fine hay" in British Guiana, and to mature in six or eight weeks from the time of sowing. "For this purpose teff is well worth cultivating. It is cleaner and brighter looking than any other grass, and is readily eaten by cattle and horses." The reports from Australia and India are equally favourable. The value of this plant for fodder purposes is exceptionally high. Its chief merits in this respect are the short time it takes to mature, and its suitability to thrive in dry, sandy regions, where few other grasses would flourish equally well.

In the Proceedings of the Agri.-Hort. Society of India, 1888, p. lxxii., the following note appeared :—"The seed of this new cereal was received from Kew, and was distributed as noted in the *Proceedings* of May last. Mr. C. C. Stevens, Commissioner of Chota Nagpore, now writes: 'You will remember having given me a small acket of seed of "tcheff" for experiment. I gave it to the Rajah of Jashpore, who had it sown in two or three different localities. He has not given me very precise information, but I understand that the seed was treated exactly like the ordinary rainy weather crops. He tells me that he has saved some three or four seers of seed, and that the hill people have taken a fancy to the crop. The best thing he can do is to keep the seed and sow next season. He has sent me a bundle of plants, which I shall forward to you when a favourable opportunity occurs. The straw or grass is 4 feet or 4½ feet in length, and smells sweet.' As only about 2 ounces of the seed was supplied to Mr. Stevens, the results obtained appear very satisfactory for the first season, and if the crop is found suitable there should be no difficulty in establishing it next season."

A very full account of teff is given by Mr. J. F. Duthie, F.L.S., in the Report of the Saharunpur Gardens for the year 1888, pp. 11–12. The following extracts are of interest :—

"Seeds of this grass were sent to us last year by the Director of the Royal Gardens, Kew, with the remark that it was an Abyssinian food-grain which might prove useful for India. I have a bad opinion of it as a food-grain, but think better of it as a fodder, and have therefore classed it under the head of 'fodder plants.'

"Teff consists of two varieties, one with white seeds and the other with red seeds. The white-seeded kind is said to be cultivated in Abyssinia during the dry season and the red during the rains. We tried the two kinds here during both seasons, and found, as stated, that the white answered best for the dry season and the red for the white.

"Three sowings were made of the two kinds—the first in March, the second in April, and the third in July. The March sowing of the white variety gave an out-turn of grain at the rate of 660 lbs. per acre, while the red variety, sown on the same date, only resulted in an out-turn of 17 lbs. per acre. The crop was cut in the beginning of May, but sprang up again into a second growth and yielded a cutting of green fodder early in the rains. The note made regarding the weight of this cutting has, unfortunately, been mislaid, and I am therefore unable to give its approximate weight per acre.

"The April sowing of the white variety produced no grain, and the sowing of the red variety made at the same time only returned 11 lbs. of grain per acre. Both kinds, however, gave a good crop of fodder in the middle of July, the red variety producing 11,022 and the white 7,436 lbs. per acre. The cutting was in a half-dried state when weighed, or the figures would have amounted to a greater total.

"The July sowing of the white variety gave an out-turn of 11 lbs. of grain per acre, and the sowing made on the same date of the red resulted in an out-turn of 82 lbs. per acre. These out-turns may be looked upon as failures, and conclusively prove that teff is of no great account for cultivation on the plains as a food grain. A cutting was made across a section of the two plots of this July sowing in the middle of August, and weighed collectively in its green state, and as a result gave an out-turn of 16,000 lbs. of green fodder per acre. The out-turns of 3,116 and 2,676 lbs. noted in the statement for part of this plot really mean the out-turn of dried hay, as the fodder was weighed in the beginning of October, and was then crisp and dry. A rainy season sowing of teff may, therefore, be looked upon as capable of producing 16,000 lbs. of green fodder and from 2,000 to 3,000 lbs. of dried hay per acre.

"A sowing of ½ lb. of each kind was made at Arnigadh in the beginning of the rains, and resulted in a collective out-turn of 40 lbs. of grain. This was a remarkably good yield for the small quantity of seed sown, and proves that in hill tracts teff may yet prove a prolific food grain.

"The hay made from the teff was of exceptional good quality and was greedily eaten by the garden bullocks. When it was offered to them they were being fed upon jowar or sorghum stalks, and, as is well known, these are remarkably sweet, and cattle, when fed upon them, generally refuse other kinds of dry food until they find that sorghum is not forthcoming. Our garden cattle, however, seemed to prefer the teff hay to the sorghum, as they would not touch the latter until they had devoured the whole of the teff placed before them.

"The experience gained here in the cultivation of teff during the past year may therefore be summed up as follows :—

"When sown in the dry season it will yield a light crop of grain, and when sown in the rains it yields little or no grain, but produces abundance of green fodder which may be cured into very palatable hay where the latter is preferred. In my opinion, teff is destined to become the rye grass of India, and is well worthy of more extended trial on some of the Government fodder reserves."

Euchlæna luxurians, *Miers* (Reana luxurians, *Durieu*). "Teosinte." An annual grass of large size from Guatemala allied to the maize. The first published illustration of the plant was given in the *Botanical Magazine*, tab. 6,414. It attracted a good deal of attention about 20 years ago as a fodder plant (see *Kew Reports*, 1878, 1879 and 1880). Seeds of it were widely distributed from Kew to the East and West Indies, Australia, and tropical Africa. It is a tall, densely-tufted grass, sometimes reaching 15 feet in height, the stems are as thick as the thumb at the base, and the leaves 3 to 4 feet long, by 2 or 3 inches broad. Dr. Schomburgk in 1880 wrote from the Adelaide Botanic Garden, S. Australia : "I have now cultivated Teosinte for three years, and it is one of the most prolific fodder plants."

Mr. W. R. Robertson, Agricultural Reporter to the Government of Madras, wrote as follows in July 1883 :—"A small plot was sown with this crop ; the out-turn of green fodder was at the rate of 38,400 lb. per acre, a very large out-turn ; but, the cost of production was great, for it was necessary to irrigate the land nearly every other day, from sowing until harvest. *Reana* is undoubtedly a very heavy producer, crops grown on the farm have given enormous yields, but further experience confirms the opinions expressed regarding the crop in the last report : 'On good soils, under liberal treatment, when it can obtain plenty of rain or irrigation water, the crop grows most rapidly and luxuriantly ; but it cannot withstand a drought. Indeed the experiments made showed that a drought, which scarcely affected the *Sorghum* crops, was sufficient to check the growth of the *Reana* to such an extent as to render it useless to keep the crop standing longer. As a fodder crop in a damp warm climate, or where irrigation can be secured, it is well worthy of attention. There is perhaps no other crop, sugar cane excepted, which will produce such an enormous quantity of green plant per acre, but the fodder is very watery, and does not appear to be very palatable to stock when offered for the first time. The watery juices of the stem seem to be destitute of saccharine matter during all stages of growth.'"

The following account of the grass was given in the Report of the Botanic Garden at Bangalore for the year 1888–9, p. 13 :—"Teosinte or buffalo grass. With rich cultivation this noble grass affords an inexhaustible supply of fodder for cattle. In special instances the stalks have been known to attain a height of 18 feet, but in ordinary cultivation they are usually 6 to 8 feet, with a small colony of offsets rising up from the base of each parent stalk. Seed was first received from Mr. Blechynden, Honorary Secretary to the Agri-Horticultural Society of India, and in the subsequent year (1878–79) the following particulars of cultivation appeared in the Annual Report of the Garden :

"The forage plant *Euchlæna luxurians* has been grown experimentally on a small scale. 16 square yards of highly manured land produced 288 lbs. of dry fodder and 19 lbs. of seed. The object in culture was chiefly to obtain seed to meet the demands of correspondents, and to enable me to sow a larger piece of ground if Government should wish to extend the experiment. Cattle and horses are fond of the green grass and I think it will be a good addition to the green forage crops of the monsoon season. At any other time the crop would require irrigation, and I have a small field now under this method of culture, which will be reported on when the results are fully known."

Subsequent cultivation confirmed the truth of the above remarks, and the great value of Teosinte as a food plant has been established in many parts of India. It should be grown on all land holdings where there are horses, cows, and bullocks to be fed. If, during the dry season, small plots are raised along the channels, and in spare nooks and corners, the condition of live stock would be better maintained than we usually see it.

The latest reports of Teosinte are as follows :—

In a Report on *Agricultural Work at British Guiana* for the years 1891–92, p. 68, Messrs. Harrison and Jenman give interesting particulars as under :—*Teosinte* is an annual, but readily reproduces itself on good land from the seed shed. It soon dies out, however, on impoverished land. Though an annual, in the season of growth, if reaped young but not too short, the stubble quickly springs again, and a second and third crop can be thus taken in favourable weather. It should be sown *in situ*, and the plants thinned out as much as is necessary to give each one 9 to 12 or 16 square feet of superficial space, as it does not bear transplanting, under which the yield is poor. The following is an analysis of the seed :—

Water	12·75
Fats	3·94
*Albuminoids	9·94
†Amides, &c.	1·00
Pectose, gum, &c.	8·22
Starch	37·38
Digestible fibre	16·46
Woody fibre	9·67
Mineral matters	2·44
	100·00 (*sic.*)

The grain of this grass, from its composition, possesses a fair value, although the proportions of fibre present are somewhat high.

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* Containing nitrogen - - 1·59
† " " - - ·16

In the *Journal of the Agri.-Hort. Society of India*, 1894, p. 78, it is stated:—"A very good crop was raised this season. After the stalks had reached a height of about 5 feet, they were cut down to within 1 foot of the ground; three weeks later a second crop was ready for cutting, varying in height from 18 inches to 3 feet; a third crop was cut a month later, and yielded stalks about 2 feet high; in this manner three good cuttings were made in four months. It was found that from 4½ to 5 lbs. of seed were sufficient to sow an acre. The fodder is greatly relished by cattle."

At Lagos, on the West Coast of Africa, Mr. Millen has successfully introduced "Teosinte" as a fodder plant and in June 1894 wrote: "I have planted a quantity of plants of *Euchlœna luxurians;* it is the only fodder plant of those introduced which appears to be growing with good results."

At Saharunpur, in the *Report* for 1893 just issued, Teosinte is mentioned as having suddenly grown into demand as an annual forage grass, and seed has been harvested to meet all possible demands.

Leersia hexandra, *Sw.* "Rice-grass." A widely distributed perennial swamp-grass found in the warm regions of both hemispheres. It has a somewhat slender stem, 2 to 3 feet long, with narrow leaves and panicled spikes. In the Philippine Islands this grass is regularly cultivated, under the name of *Zacate*, for the purpose of supplying food for domestic animals. It is treated like rice, being transplanted to wet and previously ploughed meadows. Bailey found it to be one of the most relished by cattle amongst the aquatic grasses of East Australia. In Singapore it is regularly gathered in waste places as a green fodder for cattle and horses.

Panicum Colonum, *L.*—An annual grass widely distributed throughout tropical countries. It prefers a rich soil, and is often found as a weed of cultivation. In some parts of India it is cultivated for its grain. The straw is much used in the Madras Presidency and in Mysore as cattle fodder. Duthie gives the following account of this grass (*Fodder Grasses of Northern India*, p. 5):—

"It is generally considered to be one of the best kinds of fodder grass. It is abundant all over the plains, and ascends to some few thousand feet on the Himalaya. It is greedily eaten by all kinds of cattle both before and after it has flowered, the abundant crop of grain yielded by it adding materially to its nutritive value. It extends to Australia, where, it is reported, its very succulent stems grow from 2 to 8 feet in height."

Panicum maximum, *Jacq.* (P. jumentorum, *Pers.*).—"Guinea grass." Native of tropical Africa. Widely cultivated in most countries. In Brazil it is known as "Capim de Colonia." This grass was accidentally introduced to Jamaica from the Coast of Guinea as bird food about 1740. In 1794 Bryan Edwards wrote: "Most of the grazing and breeding pens were originally created and are still supported by means of this invaluable herbage, and perhaps the settlement of the 'north side' is wholly owing to the introduction of this excellent grass." In 1879 taxes were paid in Jamaica on 115,576 acres under guinea grass. It was described as "growing freely from sea-level up to nearly 5,000 feet, and when once established, except for an occasional weeding, it receives very little attention. It answers in every respect the requirements of a good fodder plant in being perennial, nutritious, and thoroughly suitable to the soil and climate." The late Dr. Imray, quoted in the Kew Report, 1879, p. 17, says, "Guinea grass may be cut down crop after crop for many years. I have had a guinea grass piece (with the weeds cut down and an occasional manuring) kept in good order for full 20 years." Guinea grass grows to the height of 3 to 6 feet. The leaves are broad and flat, with the sheathes and nodes softly hairy. The panicle is large and loose, with numerous branches. Although it usually seeds freely, it is generally propagated by root cuttings. It requires to be weeded at regular intervals, and to be manured in poor soils. When it grows rank and tall it should be cut frequently to prevent it becoming too hard and coarse. Analysis shows it to be very rich in nutritive qualities, and where this grass can be fully established it is probably the best fodder plant known for permanent cultivation. It is a favourite grass for stall-fodder, but it is sometimes necessary to guard against over-feeding with this grass alone in a rank state. It would form an excellent material for preserving in silos.

The following particulars have been published respecting the cultivation of guinea grass in India (*Dict. Econ. Prod. India*, VI., Part 1, p. 11):—

"It is best propagated by root cuttings. It should be planted about 2 feet apart, in parallel ridges, at the commencement of the rains. The rows of plants should form lines at right angles to the ridges. This arrangement will facilitate ploughing and weeding between the plants. In Madras this grass is known to resist the effects of severe droughts. In old-established fields it is advisable to pass a plough or cultivator occasionally through and across the crop, and to manure the land thoroughly. Where the plants have formed large tussocks these should be reduced by simple chopping with a spade or hoe at right angles, thus dividing each one into four parts. Of these three may be removed for planting elsewhere, or they will form excellent bedding for cattle stalls During the cold weather of Northern India the plants dry up and remain dormant until the approach of spring. In places where frosts appear manure should be applied to the roots at the commencement of the cold season. It is particularly enjoined that Guinea grass should not be grazed too closely."

The "St. Mary's Grass" in Jamaica may be a robust variety of *P. maximum* or another species. It grows in large tufts to the height of 6 to 8 feet, with the stems hard and indurated in old specimens.

Panicum bulbosum, *H.B.K.* (regarded by Munro as a variety of *P. maximum*, and found in the Southern United States) is mentioned by Vasey as likely to be of great agricultural value. "Its bulbous rootstocks contain a store of moisture which enables it to endure a protracted drought, and as the plant grows to a large size it would produce a great amount of fodder."

Panicum molle, *Swartz.* This is somewhat similar to the following *P. muticum*, with which it was confused by Grisebach in his Flora of the British West Indian Islands. According to Swartz it is a native of Surinam, and is commonly called "Dutch grass" in Jamaica. He describes it as having thick succulent stems which are readily eaten by cattle.

Panicum muticum, *Forsk.* (P. numidianum, *Lam.*; P. barbinode, *Trin.*; P. molle, *Griseb.* non *Sw.*).—It has various names, such as "Para grass," "Mauritius grass," "Scotch grass," and "Water grass." A coarse and very vigorous grass, spreading rapidly in damp places. It has succulent stems and leaves, with the nodes distinctly hairy. It roots readily at the joints, and these are even said to grow after passing through animals. Hence, this grass is regarded as unsuitable to grow in the neighbourhood of cultivated land. Its use is also discouraged as fodder for animals specially kept for manure. For general pasture purposes it is, however, one of the best of tropical grasses. In Barbados, 40 acres of this grass, well manured and irrigated, are said to yield in good years cut-grass of the annual value of 600*l.* It is largely cultivated elsewhere in the West Indies, in Florida (where it is said to make heavy growth on high pine-ridges), in Curaçoa (where it is regarded as capable of resisting drought), and also in Ceylon, Mauritius, and in the plains of Bengal. It is readily propagated by seed and by cuttings of the root and stem.

Seeds and plants of Para grass were first introduced from Caracas to Barbados by Colonel Reid, Governor of the Windward Islands, in 1847. Later a supply was received in this country, and forwarded to Kew, with the following letter from Earl Grey, Secretary of State for the Colonial and War Department, addressed to Sir William Hooker, dated 30 June 1849:—

"I am directed by Earl Grey to transmit to you a copy of a despatch from the Lieutenant-Governor of St. Lucia, stating that he had transmitted a few roots of the Para grass, and proposed to send some seeds when he should have been able to collect a sufficient quantity.

"The roots and seeds having arrived, they are also now forwarded to you, together with a copy of the despatch from Colonel Reid, late Governor-in-Chief of the Windward Islands, in which the valuable qualities of this grass are described. Lord Grey requests that you will have the goodness to take charge of these roots and seeds, and to cause them to be prepared for transmission to the different Australian Colonies, to the Cape of Good Hope, and to the Mauritius.

"I am also to transmit to you a case containing some slips of this grass, which has been forwarded to Lord Grey from the Caracas. His Lordship would be glad to be furnished with any suggestions which may occur to you as to the best mode of proceeding in order to introduce these seeds and plants into those colonies for which they are best fitted. —I have, &c., (Signed) B. HAWES."

The correspondence in regard to the introduction of Para grass to Barbados is given by Dr. Lindley in the *Journ. Roy. Hort. Soc.*, iv. (1847) p. 148. Adapting the name given to the grass in Curaçoa, Dr. Lindley called it *Panicum jumentorum*, thus confusing it with Guinea grass.

Further supplies of Para grass were received at Kew in six Wardian cases, shipped from Caracas by Her Majesty's Consul, Mr. J. Riddel. From these plants distribution was made (with full directions for cultivation) to various colonies in the eastern hemisphere, including New South Wales, Western Australia, Ascension, &c. In the first reports it was stated that Para grass was capable of resisting drought. This was shown by Mr. Riddel to be an error. It evidently prefers and, indeed, will only flourish in localities where it has abundant moisture. It is interesting to note that this distribution of Para grass from Kew by Sir William Hooker was one of the early operations undertaken by him to assist industries in the colonies. Such operations, since that time, have been consistently carried on for nearly 50 years.

The following extract from the report of the Government Experimental Farm, Poona, for the year ending March 31, 1894 (p. 5), gives the results of the experimental cultivation in India :—

"Mauritius Water Grass or Buffalo Grass.—This is the chief fodder grass of Ceylon. There it remains green all the year round, and is employed largely for feeding milk cattle. A few roots were obtained from the School of Agriculture Farm, Colombo. The plant can be propagated either from the roots or from the stoloniferous stems which grow out laterally along the ground, and root at every node. From these rooted nodes straight shoots spring up. When ready to cut, the grass is very thick, and stands about 18 inches high. Cattle like it, but it grows slower than Guinea grass, and does not give the same out-turn. It has this advantage, it thrives well in a damp, even a wet, situation. The best method of propagating is to cut the long lateral stems into short lengths. Broadcast these sparingly over the surface, and cover lightly with soil. The plot on the farm since it has become fully established has been cut twice, at an interval of 87 days. The yields of green fodder were :—

	Yield per Acre. lbs.
1st cutting - - -	10,700
2nd cutting - - -	18,020."

Panicum spectabile, *Nees.*—A valuable fodder plant long established in Brazil and other parts of tropical America. It is known as "Capim de Angola." According to Spruce it is also called "Canna Rana." The stem is stout, 5 to 6 feet high, with the nodes softly bearded. The leaves are 3 feet long and about an inch broad. The spikes are numerous, with the spikelets arranged in 4–6 series. It belongs to the same section of *Panicum* as the "Cockspur grass" (*P. Crus-galli*). By some it is regarded as only a robust variety of that species. The Brazilian specimens in the Kew Herbarium are, however, well marked. This grass was introduced, according to Martius, *Fl. Bras.*, ii., pt. 2, p. 143, from the South-West Coast of Africa. It prefers moist situations, and spreads rapidly everywhere. On the Niger, Barter described it as "an aquatic grass 6 feet high." In East Africa Kirk speaks of it as supplying "the richest fodder for cattle." It is very widely spread in tropical America, in Cuba (Wright), Jamaica (MacFadyen), various parts of Brazil, and south as far as Paraguay. It is a very desirable grass to introduce into the East Indies. Seeds of "Capim de Angola" sent to Kew by Glaziou (*Kew Reports*, 1880, p. 16) proved to be "Para grass" (*Panicum muticum*, Forsk.).

Panicum texanum, *Buckley.* — "Blue-grass," "Colorado grass," "Buffalo grass," or "Austin grass." An annual grass little known outside Texas. The plant is furnished with an abundance of rather short, broad leaves, and the stems, which are rather weak, are often produced in considerable number from a single root. It grows usually from 2 to 4 feet high. It prefers rich, alluvial soils, but stands drought well, though on dry uplands the yield is much reduced. It is especially valuable for hay.

Paspalum conjugatum, *Berg.*—"Sour grass" of Jamaica. "Green grass" of Singapore. A low grass rooting at the nodes, seldom more than 1 to 2 feet high, leaves bright green, flat, and ciliate. The flowers arranged in two divergent spikes at the top of the stem. Widely distributed throughout tropical America and Africa. Introduced to Ceylon and East Indies. In Jamaica this grass forms the excellent "low-bite" pastures in the warmer parts of the island. It spreads rapidly, and covers the ground to the exclusion of everything else. In Ceylon this grass was described by Dr. Thwaites as growing well in shade and in places exposed to the sun, and it retained its fresh green appearance even during the dry season. It is a somewhat coarse grass, but when cut and slightly dried it has been found a very acceptable food to cattle and horses. In Singapore this grass is equally valued, and it deserves to be more widely known in the East.

Paspalum distichum, *L.* (B. vaginatum, *Sw.*).—"Silt grass" or "Water couch." A coarse, somewhat tall grass, with creeping rhizomes and convolute, rarely flat, leaves. The flowers are arranged in two spikes. It is a common grass in pastures and wet places in tropical America, and extending also into temperate countries. It is said to be naturalized in South-Western France. Probably indigenous to Australia, where it endures some frost, and is temporarily inundated. Will grow half emerging in shallow pools or wet meadows, and proves quickly fattening to cattle. It keeps beautifully green throughout the year, affords a sufficiently tender blade for feed, and is excellently adapted to cover silt or bare slopes on banks of ponds or rivers (Mueller).

Paspalum sanguinale, *Lam.* (Panicum sanguinale, *Lam.*).—A widely diffused annual grass, found in all warm regions of the globe. The stems usually rise to the height of 2 to 3 feet, and at the summit have from three to six slender flower spikes, each from 4 to 6 inches long. In cultivated areas this grass is a troublesome weed, as it spreads with amazing rapidity. Known in the United States as "Crab grass," where it is recognised as the most useful of all pasture grasses, it makes a sweet hay, and horses are exceedingly fond of it. Cotton and corn-fields in the south are often so overrun with it that the hay which might be secured would be more valuable than the original crop. In Fiji, Singapore, and Ceylon it is widely diffused near gardens and plantations. In the former country it is "the best pasture grass," while at Singapore Ridley says it makes an excellent "turf grass."

Panicum pabulare, *Aitch. & Hemsl.* (P. ciliare, *D.C.*) is a variety of ***P. sanguinale*** described by Aitchison as the best fodder grass for cattle in the Kuram Valley of Afghanistan.

Paspalum scrobiculatum, *L.*—"Kodo", or "Koda" Millet of India. An erect growing annual grass, with stems about 2 feet in height. It is widely dispersed through the tropics of the eastern hemisphere, generally regarded as a valuable pasture grass, and as an ingredient for hay. It sometimes attains a height of 6 to 8 feet. The grain is largely used as food by the natives of India, but it is by no means a wholesome article of diet. Unless special precautions are taken, it is liable to act as a narcotic poison. Cattle, and especially buffaloes, eat the grass readily when it is young. The straw is occasionally used as fodder. Animals are, however, carefully excluded from the fields when the crop is ripening, as they appear to suffer even more than men from the ill effects of *Kodra* poisoning. It is the "Ditch-millet" of New South Wales and the *Herbe à épée* of Mauritius.

Stenotaphrum americanum, *Kunth.* (S. dimidiatum, *Trin.*).—"Pimento grass" (Jamaica), "Buffalo grass" (Australia). A perennial creeping grass, with wide-spreading rhizomes, seldom more than a foot high. Each joint of the rhizome bears a tuft of smooth, pale-green leaves. The panicle is 3 to 4 inches long, with a flat jointed rachis. This is an excellent grass for binding sea sand and loose soil of river banks. It flourishes on dry limestone soils in Jamaica, and affords nourishing food for animals pastured under the pimento trees. Hence its name. There seems to be a diversity of opinion as to its merits as a fodder plant in other countries. It keeps alive in the hottest and driest region of Central Australia, where it was introduced by Sir F. von Mueller. It was successfully established also at Ascension, and it flourishes on the singularly arid volcanic rocks of that island. The plant has been grown for many years in pots and under the stage in the cool Economic House at Kew.

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CCCCXXI.—DECADES KEWENSES.

PLANTARUM NOVARUM IN HERBARIO HORTI REGII CONSERVATARUM.

DECAS XI.

101. **Paliurus orientalis**, *Hemsl.* [Rhamnaceæ]; arborescens, glaber, ramulis floriferis semper inermibus cinereis demum nigrescentibus, foliis pro genere amplis demum subcoriaceis lanceolatis ovatis vel fere rotundatis acuminatis vix acutis basi obliquis subcuneatis vel rotundatis

crenulato-dentatis trinerviis supra demum subnitidis, floribus breviter fasciculato-paniculatis graciliter pedicellatis, sepalis crassis ovatis subobtusis reticulato-venosis, petalis cucullatis, antheris magnis didymis, fructu amplo crispato obscure lobulato.—*Paliurus australis*, Gærtn. var. *orientalis*, Franchet, Pl. Delavay. p. 132; *Paliurus australis*, Franchet, Pl. David. p. 71, non Gærtn.

Habitat.—China: in woods near Tali, Yunnan, *Delavay*; South Wushan, Szechuen, *A. Henry*, 7,205; Kwangtung, *C. Ford*, 325.

Arbor usque ad 30 ped. alta (*A. Henry*). *Folia* cum petiolo usque ad 5 poll. longa et 3 poll. lata, sed in speciminibus Delavayanis minora. *Paniculæ* 1–2 poll. longæ. *Flores* circiter 3 lin. diametro. *Fructus* 1–1¼ poll. diametro.

As Mr. Franchet very truly observes, there is little in the flowers and fruit to distinguish this from the Mediterranean *P. australis*, but in habit, size, and foliage it is very different. Franchet describes the trunk as being armed with stout spines.

102. **Paliurus hirsutus**, *Hemsl.* [Rhamnaceæ]; arborescens, ramulis floriferis graciliusculis pubescentibus angulatis flexuosis ad nodos 1–spinosis, spinis brevibus rigidis recurvis, foliis graciliter petiolatis chartaceis amplis rotundato-ovatis basi obliquis subcordatis vel rotundatis apice breviter acuminatis subacutis minutissime calloso-crenulato-dentatis trinerviis cum venis lateralibus conspicuis supra strigillosis subtus præcipue secus venas fulvo-pubescentibus, floribus breviter cymoso-paniculatis pubescentibus breviter pedicellatis, sepalis crassis subobtusis quam petala paullo brevioribus, filamentis filiformibus petala æquantibus, fructu maturo ignoto sed ut videtur anguste cupulato-alato glabro.

Habitat.—China: Kwangtung, *Ford*, 280.

Arbor parva (*Ford*). *Folia*, cum petiolo circiter 6–9 lineas longo, 3–4 poll. longa. *Spinæ* 1½–3 lineas longæ. *Cymæ* circiter pollicares. *Flores* 2½ lin. diametro.

It is noteworthy that no member of this genus has been found between Persia and China and only one species is known in the western area of the genus. Carrière (*Revue Horticole*, 1866, p. 380) mentions a *Paliurus lucidus* from China; but as he merely states that it is less spiny than *P. aculeatus*, Poir., with very shiny leaves, it is impossible to say what it is without seeing specimens.

The synonymy of the Mediterranean species has been misunderstood and should be as follows:—*P. Spina-Christi*, Mill., syn. *P. australis*, Gærtn., and *P. aculeatus*, Poir.

103. **Bothriocline laxa**, *N. E. Brown* [Compositæ-Vernoniaceæ]; herbacea, caulibus ramulisque sulcato-striatis pilosis, foliis alternis vel oppositis petiolatis lanceolatis oblongo-lanceolatis vel obovato-lanceolatis acutis basi cuneato-acutis marginibus serratis supra sparse hirtis subtus sparse pubescentibus glanduloso-punctatis, inflorescentia laxe paniculato-corymbosa, pedunculis pedicellisque gracilibus pilosis, capitulis 20–25 floris, involucri campanulati bracteis 5–6 seriatis ovato-lanceolatis acuminatis mucronatis pungentibus exterioribus dorso sparse pilosis et piloso-ciliatis cæteris glabris dorso glanduliferis marginibus minute ciliolatis viridibus interioribus apice purpureis flores excedentibus, corolla purpurea extus glandulifera quinquefida lobis lineari-lanceolatis acutis quam stigmata paullo longioribus, pappi setis caducis scabris, achæniis turbinatis leviter curvatis quinque-sulcatis glabris.

Habitat.—Transvaal, Primers Creek, Barberton 3,000 ft. April, *Galpin*, 916; Shire Highlands, near Blantyre, *Last.*

Planta 1½ ped. alta. *Foliorum* petioli 3–6 lin. longi, laminæ 1–4 poll. longæ, ½–1¾ poll. latæ. *Pedunculi* 1–3 poll. longi. *Pedicelli* 1½–6 lin. longi. *Capitula* 3 lin. longa, 1½–2 lin. lata. *Involucri* bracteæ exteriores 1½–2 lin. longæ, interiores 3 lin. longæ. *Corollæ* tubus 1½ lin. longus, lobi 1 lin. longi. *Achænia* ¾ lin. longa.

This is the first species of this genus that has been found south of the tropic, and is well distinguished by its very pointed involucral bracts. *Bothriocline* seems scarcely distinct from *Gutenbergia*, the presence of a caducous pappus being the only distinction, and if retained on this ground then *Gutenbergia cordifolia* must be removed to *Bothriocline* as it possesses a caducous pappus.

104. **Bothriocline longipes**, *N. E. Brown* [Compositæ-Vernoniaceæ]; caulibus ramulisque sulcato-striatis glabrescentibus, foliis oppositis petiolatis elliptico-lanceolatis vel oblanceolatis acutis tenuiter dentatis, utrinque minute pubescentibus, inflorescentia trichotomo-corymbosa ramulis pedunculisque pubescentibus, capitulis ad apicem ramulorum ultimorum binis vel ternis sessilibus 10–12-floris, involucri campanulati bracteis 3–4-seriatis ellipticis vel elliptico-oblongis obtusis apiculatis exterioribus apice pubescentibus interioribus glabris eglandulosis marginibus minutissime scabrido-ciliolatis pallidis apice viridi-maculatis omnibus quam flores purpurei duplo brevioribus, corolla sparse papillosa quinquefida lobis lineari-oblongis acutis quam stigmata subduplo brevioribus, pappi setis paucis caducis scabris, achæniis turbinatis leviter curvatis quinque-sulcatis glabris. *B. Schimperi*, Oliver and Hiern var. *longipes*, in Oliver Fl. Trop. Afr. III., p. 266.

Habitat.—Monbuttuland, *Schweinfurth*, 3197.

Foliorum petioli 4–6 lin. longi, laminæ 1½–4½ poll. longæ, ½–2 poll. latæ. *Rami* primarii corymbi 1¼–4 poll. longi. *Pedunculi* ½–1½ poll. longi. Capitula 2 lin. diam. *Involucri* bracteæ 1½–2 lin. longæ. *Corollæ* tubus 1¾ lin. longus, lobi vix 1 lin. longi. *Pappi* setæ ¾ lin. longæ. *Achænia* vix 1 lin. longa.

This is very distinct from *B. Schimperi* in its finely dentate leaves, more lax inflorescence, flower-heads not more than half the size, with less than half as many flowers and totally different involucre bracts.

105. **Buddleia pulchella**, *N. E. Brown* [Loganiaceæ]; ramulis teretibus tomentoso-pubescentibus, foliis petiolatis sæpius hastatis subpinnatifidis interdum rhomboideis vel lanceolatis acutis basi cuneatis utrinque pilis stellatis pubescentibus, paniculis sublaxis cymoso-ramosis terminalibus multifloris subincano-tomentosis, bracteis subulatis, calycis tubo cylindrico breviter 4-dentato, dentibus ovatis subobtusis, corollæ tubo longe exserto gracili recto rubescenti tomentello lobis patentibus subrectangularibus obtusis albis fauce aurantiaca odore graveolenti.

Habitat.—South Africa?

Foliorum petioli 2–3 lin. longi, laminæ 1¼–1¾ poll. longæ, ⅓–1⅓ poll. latæ. *Paniculæ* 2–2½ poll. longæ et latæ. *Bracteæ* 1–2 lin. longæ. *Calyx* 1½ lin. longus. *Corollæ* tubus 4 lin. longus, limbus 3 lin. diam.

A very distinct species, unlike any other in the genus. Most of the leaves are hastate, some have two lobes on each side, and a few are either rhomboidal or lanceolate. Described from a living plant cultivated at Kew, that was received in May 1894 from the Durban Botanic Gardens, Natal, without information as to locality.

106. **Strobopetalum carnosum**, *N. E. Brown* [Asclepiadeæ]; caulibus prostratis ut videtur glabris, foliis petiolatis anguste vel late oblongis oblongo-lanceolatis vel elliptico-oblongis acutis obtusis retusisve mucronatis basi rotundatis vel cordatis carnosis glabris, cymis pauci-vel plurifloris umbelliformibus subsessilibus vel brevissime pedunculatis, bracteis minutis lanceolatis acutis cum pedicellis sepalisque lanceolatis acuminatis glabris, corollæ tubo campanulato lobis linearibus patentibus tortis extus glabris intus basi cum tubæ fauce dense et minute adpresso-pubescentibus, coronæ lobis erectis linearibus acutis basi adnatis quam antheræ brevioribus.

Habitat.—South Arabia, El Hami, *Schweinfurth*, 180.

Foliorum petioli 1–8 lin. longi, laminæ $\frac{1}{3}$–$2\frac{1}{4}$ poll. longæ, $\frac{1}{6}$–$1\frac{1}{3}$ poll. latæ. *Pedunculi* $\frac{1}{3}$–1 lin longi. *Pedicelli* 2–3 lin. longi. *Sepala* 1 lin. longa. *Corollæ* tubus 1 lin. longus, lobi 4–$4\frac{1}{2}$ lin. longi. *Coronæ* lobi $\frac{1}{2}$ lin. longi.

The flowers are noted as green on the label.

107. **Peliostomum calycinum**, *N. E. Brown* [Scrophularineæ]; ramis angulatis glabris probabiliter decumbentibus vel prostratis, foliis adscendentibus linearibus acuminatis subrigidis (subcarnosis?) glabris, pedicellis prope apicem bibracteatis glabris, bracteis sepalisque linearibus acutis glabris, parte attenuata corollæ tubi quam calyx breviore lobis rotundatis violaceis extus sparse glanduloso-pubescentibus, staminibus didynamis quam corolla duplo brevioribus filamentis glabris, antheris ciliato-barbatis, capsulis compresso-ovatis acutis glabris, seminibus scrobiculato-tuberculatis.

Habitat.—South Africa; Transvaal, Barberton, in stony places 2,918 ft., *Thorncroft*, 72 (*Wood*, 4,171); Orange Free State, *Cooper*, 1,205.

Rami 1-3 ped. longi, ramuli 2-6 poll. longi. *Folia* $\frac{1}{2}$-1 poll. longa, $\frac{1}{2}$–1 lin. lata. *Pedicelli* $1\frac{1}{2}$–3 lin. longi. *Bracteæ* 4–5 lin. longæ, $\frac{1}{2}$ lin. latæ. *Sepala* 4–5 lin. longæ, $\frac{1}{2}$ lin. lata. *Corolla* 9 lin. longa, parte attenuata 2–$2\frac{1}{2}$ lin. longa, lobis $1\frac{1}{2}$ lin. longis et latis. *Capsula* 3-4 lin. longa.

According to a note on Mr. Cooper's label, this plant is "used by the Kaffirs in making perfume balls." But probably other sweet-scented plants are mingled with it, as the perfume balls are much more strongly scented than I find this plant to be. The leaves are probably somewhat fleshy when alive, and have a prominent mid-rib on their under side, seen only as an impressed line on the upper surface. This species is well distinguished from all the known members of the genus by its long sepals and linear leaves.

108. **Gladiolus (Hebea) flexuosus**, *Baker* [Irideæ]; cormo parvo globoso, caule gracili elongato simplice flexuoso, foliis productis 3 brevibus dissitis lineari-complicatis rigidulis glabris, floribus paucis in spicam laxam secundam dispositis, spathæ valva exteriori oblonga vel oblongo-lanceolata firmula viridi, perianthii tubo brevi cylindrico,

segmentis superioribus obovatis obtusis imbricatis, inferioribus longioribus lanceolatis longe unguiculatis, genitalibus segmentis superioribus brevioribus.

Habitat.—Fwambo, Lake Tanganyika, Jan. 1893, *Alexander Carson.*

Caulis pedalis vel sesquipedalis. *Foliorum* limbus liber 1–3 poll. longus. *Spathæ* 6–9 lin. longæ. *Perianthii* tubus 4 lin. longus; segmenta superiora 6 lin. longa, 3–4 lin. lata; segmenta inferiora 8–9 lin. longa.

Near *G. Thomsoni* and *unguiculatus*, Baker.

109. **Moræa Carsoni,** *Baker* [Irideæ]; caule gracillimo simplice elongato folio unico stricto lineari-subulato prope medium prædito, spathis paucis cylindricis pubescentibus 2–3-floris in spicam laxam dispositis, pedicellis demum protrusis, perianthio lilacino, segmentis exterioribus oblanceolatis longe unguiculatis, interioribus minoribus, styli appendicibus magnis lanceolatis, fructu parvo oblongo-clavato.

Habitat.—Fwambo, Lake Tanganyika, Feb. 1893, *Alexander Carson.*

Caulis pedalis. *Folium* subpedale. *Spathæ* 18–21 lin. longæ. *Perianthii* segmenta exteriora 12 lin. longa, 2 lin. lata.

Nearly allied to *M. Thomsoni*, Baker of Nyassaland and the Cape *M. edulis*, Ker.

110. **Lapeyrousia holostachya,** *Baker* [Irideæ]; cormo parvo ovoideo, tunicis exterioribus brunneis fibroso-membranaceis, foliis productis 4–5 linearibus glabris superpositis, caule gracili simplice elongato, floribus paucis in spicam laxam simplicem dispositis, spathæ valva exteriori lanceolata viridi, perianthio violaceo tubo gracili elongato, lobis lanceolatis subæqualibus tubo 2–3-plo brevioribus, genitalibus ex tubo breviter protusis, styli ramis patulis subulatis.

Habitat.—Fwambo, Lake Tanganyika, Feb. 1893, *Alexander Carson.*

Caulis pedalis et ultra. *Folia* centralia 8–10 poll. longa, 4–5 lin. lata. *Spathæ* 3-6 lin. longæ. *Peranthii* tubus pollicaris, lobi 4–4½ lin. longi.

Allied to the Transvaal *L. Bainesii*, Baker.

CCCCXXII.—NEW ORCHIDS. DECADE 11.

101. **Bulbophyllum pteriphilum,** *Rolfe;* caule scandente elongato, pseudobulbis distantibus oblongis monophyllis, foliis lineari-oblongis, scapis gracilibus basi vaginis imbricatis tectis, floribus numerosis distichis parvis, bracteis latissime ovato-oblongis apiculatis convolutis, sepalis lanceolato-oblongis subacutis, petalis oblanceolatis subobtusis, labello oblongo obtuso planiusculo basi bicarinato, columna brevi dentibus subulatis longis.

HAB.—Penang, *Curtis.*

Pseudobulbi 1–1½ poll. longi, 1½–2 poll. distantes. *Folia* immatura tantum visa. *Racemi* circa 4 poll. longa. *Bracteæ* ¾ lin. longæ.

Pedicelli 1 lin. longi. *Sepala* $1\frac{1}{2}$ lin. longa. *Petala* $1\frac{1}{4}$ lin. longa. *Labellum* $\frac{3}{4}$ lin. longum. *Columna* $\frac{1}{2}$ lin. longa; dentes $\frac{1}{3}$ lin. longi.

A very distinct species, which was found growing intermixed with rhizomes of *Lecanopteris carnosa*, Blume, sent to Kew by Mr. C. Curtis, of the Forest Department, Penang. It flowered in the collection in September last, and technically belongs to the group containing *B. reptans*, Lindl., but has no very near ally among Indian species. The scapes sometimes appear with the young growths, and push out from the imbricating sheaths which protect the young pseudobulb and leaf, but the majority are borne at the nodes below the mature pseudobulbs, each being protected at the base by a number of imbricating sheaths. The flowers are white, and rather under a quarter of an inch in diameter. The specific name is given in allusion to the plant's habit of growing intermixed with the rhizomes of the fern, which, however, may not be constant.

102. **Lanium Berkeleyi**, *Rolfe;* pseudobulbis lineari-oblongis subconfertis vaginis subimbricatis tectis apice 2–3-phyllis, foliis oblongis subacutis v. apiculatis, scapis parce ramosis v. simplicibus pubescentibus, bracteis triangulo-ovatis acutis, pedicellis pubescentibus, sepalis patentibus lanceolatis acutis extus pubescentibus, petalis patentibus filiformi-linearibus acutis, labello basi columnæ adnato erecto ovato acuto concavo disco basi bidentato, columna clavata.

HAB.—Brazil.

Pseudobulbi $\frac{3}{4}$–$1\frac{1}{4}$ poll. longi. *Folia* $\frac{3}{4}$–$1\frac{1}{2}$ poll. longa, 3–5 lin. lata. *Scapi* 2–4 poll. longi. *Bracteæ* $1\frac{1}{2}$ lin. longæ. *Pedicelli* $2\frac{1}{2}$–3 lin. longi. *Sepala* $2\frac{1}{2}$ lin. longa, $\frac{1}{2}$–$\frac{3}{4}$ lin. lata. *Petala* $2\frac{1}{2}$ lin. longa. *Labellum* $2\frac{1}{2}$ lin. longum. *Columna* $1\frac{1}{2}$ lin. longa.

The third species of this curious little group, which Lindley considered as a section of *Epidendrum*, though Bentham afterwards elevated it to the rank of a distinct genus. It was found in a clump of *Cattleya guttata* by Major-General E. S. Berkeley, Spetchley, Bitterne Park, Southampton, with whom it flowered in January 1891; and now Messrs. F. Sander & Co., St. Albans, have also flowered it among their Brazilian importations. It is easily distinguished from *L. Avicula*, Benth., the other Brazilian species, by its much longer and narrower pseudobulbs and leaves, and less branched raceme. The flowers are light green with numerous minute red-brown dots on the sepals, petals, and base of the column.

103. **Epidendrum Pfavii**, *Rolfe;* caule erecto alto folioso, foliis lanceolatis acutis, spathis pluribus imbricatis oblongo-lanceolatis acutis conduplicatis, racemis arcuatis multifloris, bracteis lanceolatis acuminatis, sepalis oblanceolato-oblongis subobtusis, petalis spathulato-linearibus obtusis, labelli ungue ad apicem columnæ adnato, limbo trilobo lobis lateralibus amplis dolabriformibus intermedio bifido laciniis lineari-oblongis obtusis.

HAB.—Costa Rica, *Pfau.*

Planta 4–6 ped. alta. *Folia* . . . *Spathæ* 2–$4\frac{1}{2}$ poll. longæ. *Racemi* 3–$4\frac{1}{2}$ poll. longi. *Bracteæ* 5–6 lin. longæ. *Pedicelli* $1\frac{1}{2}$–$2\frac{1}{4}$ lin. longi. *Sepala et petala* 10 lin. longa. *Labellum* 7 lin. latum. *Columna* 6 lin. longa.

A stately species, of which a dried inflorescence and partly-coloured sketch have been sent to Kew by Mr. Richard Pfau, of Costa Rica. It is allied to the Brazilian *E. cooperianum*, Batem. Mr. Pfau describes it as a truly superb plant, growing from four to six feet high, clothed with lanceolate acute leaves and bearing at the summit numerous racemes of pinkish-purple flowers with a white disc to the lip. The materials sent confirm the statement, but no leaf was sent, so that we cannot give the dimensions.

104. **Polystachya villosa**, *Rolfe;* foliis lineari-lanceolatis acutis elongatis, scapis erectis villosis, racemis multifloris, bracteis triangulari-ovatis acuminatis carinatis villosis, pedicellis villosis, sepalis extus villosis postico ovato acuto lateralibus paullo latioribus carinatis, petalis obovato-oblongis acutis, labello recurvo trilobo lobis lateralibus erectis oblique oblongis obtusis intermedio late orbiculari-ovato apice subobtuso recurvo disco puberulo ecalloso, columna brevissima.

Hab.—Upper Zambesi, E. Tropical Africa.

Folia 10 poll. longa, 5 lin. lata. *Scapi* 3 poll. longi. *Bracteæ* 4 lin. longæ. *Pedicelli* 3 lin. longi. *Sepala* 4 lin. longa. *Petala* 2½ lin. longa. *Labellum* 2 lin. longum. *Columna* ½ lin. longa.

A very distinct and interesting little plant, which flowered with Mr. James O'Brien of Harrow-on-the-Hill, in September 1890, and with M. A. Van Imschoot, of Gand, four years later, from both of whom materials were received for determination. It is quite unlike any other known species in its softly villose inflorescence, which is of a pale whitish green, like that of some species of *Sphagnum*. The lip is white with minute purple spots on the disc, and a light yellow line on the basal half.

105. **Chondrorhyncha bicolor**, *Rolfe;* cæspitosa, foliis lineari-lanceolatis acuminatis basi attenuatis, scapis brevibus unifloris, bracteis ovatis acutis, sepalo postico erecto oblongo obtuso apiculato lateralibus patentibus lineari-oblongis subobtusis apiculatis, petalis oblongis obtusis apiculatis, labello subtrilobo lobis lateralibus anguste oblongis erectis intermedio patente reniformi-orbiculari retuso crenulato obtuse carinato ecalloso, columna clavata.

Hab.—Costa Rica, *Pfau.*

Folia 1¼–2 ped. longa, ¾–1 poll. lata. *Scapi* 2 poll. alti. *Bracteæ* 4 lin. longæ. *Sepala* 1 poll. longa, posticum 4½ lin. latum, lateralia 2½ lin. lata. *Petala* ¾ poll. longa, 3 lin. lata. *Labellum* 11 lin. longum, 8 lin. latum. *Columna* ½ poll. longa.

An interesting addition to this singular little genus, of which living plants and dried specimens, together with a coloured sketch, have been sent to Kew by Mr. Richard Pfau, of Costa Rica. The flowers are white, with some purple markings on the middle and base of the lip. The scapes are technically described as one-flowered in this group, though in the present species they are not so in reality. The flowering axis is very short, and concealed in the axis of the leaf, whence several one-flowered peduncles are pushed up, probably in succession. The character may extend to other species, both of this and allied genera with a similar habit.

106. **Catasetum Lemosii**, *Rolfe;* pseudobulbis fusiformi-oblongis, foliis elliptico-oblongis acutis v. apiculatis undulatis, scapis erectis

strictis multifloris, bracteis oblongo-lanceolatis acutis, sepalo postico erecto oblongo-lanceolato acuto concavo lateralibus patentibus ovato-lanceolatis acutis concavis, petalis erectis elliptico-ovatis acutis convexis, labello galeato trilobo ore late obcordato, lobis lateralibus quadrato-rotundatis denticulatis intermedio triangulari acuto reflexo, columna oblonga rostrata antennis gracilibus apice confertis.—*Catasetum roseum*, Rodr. Gen. et Sp. Orch. Nov., I., p. 128 (non Rchb. f.).

Hab.—Brazil, Rio de Fabrica, Ile de Marajo, *Rodrigues.* Upper Amazón, *Lemos.*

Pseudobulbi 5–6 poll. longi. *Folia* 8 poll. longa, 2¼ poll. lata. *Scapi* ¾-1 ped. longi. *Bracteæ* 4–5 poll. longæ. *Pedicelli* 7–9 lin. longi. *Sepala* 9 lin. longa, 3 lin. lata. *Petala* 9 lin. longa, 5 lin. lata. *Labellum* 7–8 lin. longum, 6–7 lin. latum. *Columna* 4–5 lin. longa.

This species was imperfectly described by Barbosa Rodrigues, in 1877, under the name of *Catasetum roseum*, but as there is already a species of that name (*Catasetum roseum*, Rchb. f., in Gard. Chron., 1872, p. 1003) the present one must be renamed. It is therefore proposed to call it *C. Lemosii*, after Dr. Lemos, Superintendent of Schools for the Province of Pará, who collected and gave it to Mr. E. S. Rand, of Para, from whom a fine specimen has been received at Kew. It is allied to *C. albovirens*, Rodr. The sepals and petals are brownish flesh-colour, ultimately becoming tawny yellow, and the lip light green with some yellow inside. Rodrigues describes them as rose, but they are not so in his coloured drawing, nor in a specimen which flowered in the collection of M. Robinow, Esq., Hawthornden, Palatine Road, Didsbury, in May 1892. The female flowers are still unknown.

107. **Catasetum Randii**, *Rolfe;* pseudobulbis ovoideo-oblongis, foliis oblongo-lanceolatis acutis, florum ♂ scapis arcuatis 9-floris, bracteis oblongo-lanceolatis acutis, sepalo postico erecto oblongo-lanceolato acuto concavo lateralibus patentibus conformibus, petalis erectis parallelis lanceolatis acutis convexis, labello infero trilobo lobis lateralibus late oblongis obtusis fimbriatis intermedio oblongo margine et facie longe setaceo-fimbriato apice rostrato recurvo medio saccato basi cristato, crista erecta lata apice tuberculato-fimbriata, columna clavata rostrata antennis incurvis contractis, florum ♀ scapis erectis bifloris, bracteis ovato-oblongis acutis, sepalis petalisque reflexis oblongis subacutis, labello supero galeato apiculato margine minute denticulato, columna brevi crassissima apiculata.

Hab.—Brazil, Rand.

Pseudobulbi 1½–2¼ poll. longi. *Folia* 5–7 poll. longa. *Scapi* 4 poll. longi. *Bracteæ* fl. ♂ 2½–3½ lin. longæ, 1 lin. latæ. *Sepala* et *petala* 10–12 lin. longa, 3–4 lin. lata. *Labellum* 6 lin. longum, basi 4 lin. latum. *Columna* 6 lin. longa. *Bracteæ* fl. ♀ 4 lin. longæ, 2 lin. latæ. *Sepala* et *petala* 7 lin. longa, 3 lin. lata. *Labellum* 7½ lin. longum, 6 lin. latum. *Columna* 3 lin. longa.

A very interesting little plant, sent to Kew by E. S. Rand, Esq., of Pará, who obtained it from the Upper Amazon, above Manaõs. When under cultivation at Pará a male and female inflorescence were produced on either side of the same pseudobulb, and these were put in spirit and sent to Kew together with a living plant. It is allied to *C. garnettianum*, Rolfe, which it closely resembles in habit, but is quite different in the details of the lip, especially in the crest, which in the present species is a short and broad brush-like appendage with many teeth, but in the other a single slender spine-like organ. The female flowers are, as usual, very fleshy, and of a uniform clear apple green, becoming yellow with age, while the males are more membranaceous, and irregularly dotted with purple-brown on a green ground, the spots on the lip being very minute, and the crest white.

108. **Ornithidium nanum**, *Rolfe*; caulibus repentibus vaginis imbricatis obtectis, pseudobulbis parvis lineari-oblongis monophyllis subconfertis, foliis lineari-lanceolatis acutis carnosissimis supra canaliculatis, floribus lateralibus solitariis, pedunculis brevibus, bracteis ovatis acutis, sepalo postico ovato-lanceolato acuto, lateralibus triangulari-lanceolatis acutis basi cum columnæ pede in mentum conicum extensis, petalis lanceolatis subacutis, labello integro spathulato obtuso, callo lineari obtuse carnoso, columna clavata alis triangulari-oblongis acutis.

Hab.—W. Indies.

Planta 1–1½ poll. alta. *Pseudobulbi* 3–3½ lin. longi. *Folia* ½–1 poll. longa, 1–1¾ lin. lata. *Pedunculi* 7–8 lin. longi. *Bracteæ* 2 lin. longæ. *Sepalum posticum* 4 lin. longum, 1½ lin. latum; lateralia 6 lin. longa, 2½ lin. lata. *Petala* 3½ lin. longa, 1½ lin. lata. *Labellum* 5 lin. longum, 1¾ lin. latum. *Columna* 2½ lin. longa, alæ ½ lin. longæ. *Mentum* 3 lin. longum.

A remarkable little plant, not much exceeding an inch high, and quite unlike any other known species. It was sent to Kew by Mr. Wilke, Superintendent of the Rotterdam Zoological Gardens, and bloomed in the collection during September last. The flowers are yellowish white, and bear much resemblance to those of *Dendrobium crumenatum* in shape.

109. **Trichocentrum Hartii**, *Rolfe*; foliis oblongis subobtusis carnosis, scapis brevibus univelpaucifloris, bracteis late ovatis acutis conduplicatis, sepalis elliptico-oblongis subacutis concavis, petalis paulo latioribus subobtusis, labello brevissime unguiculato pandurato-oblongo obtuso basi bilamellato lamellis bidentatis, calcare quam labellum breviore apice curvato, columna brevissima alis late obovatis fimbriatis.

Hab.—Venezuela.

Folia 1½–2½ poll. longa, ½–1 poll. lata. *Scapi* 1 poll. longi. *Bracteæ* 1 lin. longæ. *Pedicelli* 9 lin. longi. *Sepala* 5 lin. longa, 2–2½ lin. lata. *Petala* 5 lin. longa, 3 lin. lata. *Labellum* 19 lin. longum, 5 lin. latum. *Calcar* 7 lin. longum. *Columna* 1½ lin. longa; alæ 2 lin. longæ, 2 lin. latæ.

A species sent to Kew by J. H. Hart, Esq., F.L.S., Superintendent of the Royal Botanic Garden, Trinidad, who had received it from Venezuela. It is allied to *T. fuscum*, Lindl., which differs in having a straight spur longer than the lip, and the sepals and petals fully two-thirds as long as the same organ, while in the present one they are only half as long. The flower is light yellow with the exception of the lip, which is white, with some brownish red stripes on the crest, and a few minute spots of the same colour on the column-wings. A flower of what is evidently the same species was sent from the collection of Sir Trevor Lawrence, Bart., Burford, Dorking, in September 1892, but could not be identified. The plant had been obtained from Messrs. Linden, of Brussels.

110. **Sarcochilus crassifolius**, *Rolfe*; caule ancipite scandente distichophyllo, foliis breviter petiolatis ovato-oblongis subacutis crasso-carnosis supra canaliculatis subtus carinatis pallide viridibus, pedunculis brevibus teretibus paucifloris, bracteis late triangulari-ovatis subacutis, sepalis petalisque elliptico-oblongis subobtusis concavis, labello unguiculato trilobo lobis lateralibus falcato-oblongis membranaceis, intermedio triangulari-ovato obtuso carnoso, callo parvo didymo, columna brevi subalata.

HAB.—Not known.

Caules 3–4 lin. lati. *Folia* $1\frac{3}{4}$-2 poll. longa, 6–9 lin. lata; petiolus 2–$2\frac{1}{2}$ lin. longus. *Pedunculi* $\frac{1}{2}$–$\frac{3}{4}$ poll. longi. *Bracteæ* $\frac{3}{4}$ lin. longæ. *Pedunculi* 2–$2\frac{1}{2}$ lin. longi. *Sepala* $3\frac{1}{2}$–4 lin. longa, $1\frac{1}{2}$ lin. lata. *Petala* sepalis subæqualia. *Labellum* 2 lin. longum, $3\frac{1}{2}$ lin. latum. *Columna* $\frac{3}{4}$ lin. longa.

A climbing species, with curiously flattened stem, which flowered in the collection of M. A. Van Imschoot, of Mont-St.-Amand, Gand, in October last. It is apparently allied to the Javan *S. anceps*, Rchb. f., a species only known from the very short description, but which, however, has a filiform peduncle. The flowers are yellowish white, with the front lobe of the lip yellow, and an orange blotch behind the crest.

CCCCXXIII.—PLAGUE OF CATERPILLARS AT HONG KONG.

(*Metanastria punctata*, Walker.)

In the *Kew Bulletin*, 1890, pp. 224–229, there appeared an account, communicated by the Foreign Office, of a serious forest plague in Bavaria caused by the caterpillars of a moth known as *Liparis Monacha*. The Bavarian plague was estimated to cause the loss amongst pine trees in one year of nearly 40,000*l*. In some of the forests attacked the excreta from the caterpillars was lying 6 inches deep.

This year a somewhat similar plague of caterpillars appeared on pine trees in the island of Hong Kong and on the mainland of China, in British Kowloon. These caterpillars also belonged to a large moth (*Metanastria punctata*, Walker). This species is apparently not known out of China, but it is not remote, according to Mr. W. F. H. Blandford, F.E.S., from the European *Gastropacha pini*.

In Hong Kong the trees attacked were those of *Pinus sinensis*, Lamb., very largely planted in the island for re-foresting purposes. A report on the caterpillar plague at Hong Kong has recently been communicated to Kew by the Secretary of State for the Colonies. This was prepared by Mr. W. J. Tutcher, the acting superintendent of the Botanical and Afforestation Department. The caterpillars were first seen towards the end of April, when the insects were not more than two or three lines in length. At that time the pest had not commenced its ravages, but knowing its habits by past experience, and in view of the fact that the numbers were greatly in excess of anything seen before, active steps were taken by Government to employ Chinese to collect them, and to establish *depôts* in various parts of the island where the caterpillars could be received and paid for by weight. The caterpillars were caught by simply shaking the trees and picking them off the ground by means of pincers, or with the fingers encased in cloth. These precautions were necessary, as the caterpillars were furnished with stinging hairs, causing a good deal of pain if incautiously handled. They were destroyed by boiling water, after which they were buried.

The plague lasted for two months. The quantity of caterpillars collected was over 60,000 catties, and weighed nearly 36 tons. Cocoons to the weight of 5,000 catties were also collected. Altogether it is estimated that about 35,000,000 insects were destroyed. The cost was 5,000 dollars.

The cause of the large increase in the caterpillars this year is attributed to the exceptionally severe winter of 1892–93, which was possibly unfavourable to some natural foe which kept the increase of the caterpillars in check. The markings on the caterpillars correspond very closely with scars on the branches of the pine trees. On this account the caterpillars are very difficult to see, even when they are fully developed. They are then about 3 inches long and a quarter of an inch in breadth. "This close resemblance to the branches of the trees points to a form of protection from some other insect or bird." Another point in favour of the suggestion that the severe weather had killed its foe is the fact that the caterpillar had been known on the mainland for several years past, but previous to the winter of 1892–93 it had not been known to do considerable damage.

According to observations this year, the life history of the insect is as follows: The first eggs were laid at the end of April. The caterpillars became chrysalids at the end of May or beginning of June. The moths appeared in the middle of June, and they were depositing the second lot of eggs in July.

The report concludes as follows: "It is satisfactory to know that the methods employed for the extirpation of the scourge have been decidedly successful; of the many thousands of trees attacked, only a very small per-centage have been killed, and many of those that have had some of their leaves destroyed are recovering. The pest, which at one time threatened the destruction of all the pine trees in the colony, has, for the present at least, been most successfully coped with."

CCCCXXIV.—MISCELLANEOUS NOTES.

The Director has been elected an honorary member of the New Zealand Institute in recognition, amongst other grounds, "of the aid he [or rather Kew] has so cordially rendered to botanists in the British colonies."

Fleet-Paymaster **William Wykeham Perry**, R.N.—This officer, whose services to Kew deserve some record, died on the 14th of June, 1894, at the early age of 48, a fact that only recently came to our knowledge. Mr. Perry distinguished himself 19 years ago by an act of gallant courage. When Commodore Goodenough was fatally wounded in the Pacific by what was believed to be a poisoned arrow, Mr. Perry, although suffering from a sore mouth, devotedly sucked the wound, unhappily without avail. In 1873, with the co-operation of Commodore Goodenough, he obtained a specimen of the only kind of tree that inhabits the remote Amsterdam Island in the South Indian Ocean. The existence of trees on the island had been observed eighty years previously, but not until Mr. Perry sent a specimen to Kew, was it known to be the same (*Phylica arborea*) as that inhabiting the 5,000 miles-distant Tristan d'Acunha group. Subsequently, when stationed in the Red Sea, Mr. Perry obtained, with the assistance of Captain Hunter, specimens of the Myrrh and Olibanum trees of Somaliland. He was also the first to bring to Europe living plants of the plant yielding Socotrine aloes, which proving new to science was named in his honour *Aloe Perryi.* He further succeeded in procuring a specimen of the Dragon's Blood tree of Socotra, which yields the drug called cinnabar by Dioscorides. It has since been described under the name of *Dracæna Cinnabari.* Independently of the foregoing important acquisitions, Mr. Perry collected at Aden, on the Somali coast, in the Persian Gulf, in Scind, and in Madagascar and Johanna Island. These collections were all transmitted to Kew, and though not large, they invariably contained some interesting plants. His last collection, received in 1883, was more extensive, comprising upwards of 250 species from Corea, Mandshuria, Formosa, and the coast of China. These have been worked up in Forbes and Hemsley's *Index Floræ sinensis.*

The great **Temperate House,** or Winter Garden, was commenced in 1860 from designs by Decimus Burton. In 1861 the octagons (50 feet diameter) were finished. In 1862 the centre block (212 by 137 feet and 60 feet high) was completed. The original design included two wings (each 112 by 62 feet). These, however, were never erected, though the raised terrace was prepared for them.

The Treasury has now sanctioned the erection of the southern wing, and the proposed works are being already taken in hand. It is proposed to maintain in this a warm greenhouse temperature so as to allow the adequate cultivation of many economic and large succulent plants of which the existing accommodation afforded them at Kew does not permit the satisfactory development.

Lecanopteris carnosa, *Blume.*—The genus *Lecanopteris* is allied to *Dicksonia* and *Deparia,* and contains four or five species, all natives of Malaisia. It was formerly included in *Polypodium,* and *L. carnosa,* Blume, was supposed by Sir William Hooker to be an abnormal form of *P. lomarioides* (*Synopsis Filicum*; p. 365). It is remarkable in the form and manner of growth of its rhizome, which forms an irregular putty-like crust surrounding the branches of trees, to which it clings by means of short brown fibrous roots. The rhizome is glaucous green, fleshy, and scaleless, becoming brown and leathery in texture with age. Its interior is full of small cavities or galleries, similar to the myrmecophilous *Hydnophytum* and *Myrmecodia* from the same region. The leaves are pinnate, from six inches to a foot long, and they spring from raised points or mammæ, which occur about an inch apart all over the rhizome. There is a good picture of this species, with a note on its peculiarities, by

Burck in *Annales du Jardin botanique de Buitenzorg*, vol. iv., p. 96, t. 7, where it is called *Polypodium patelliferum*. A second species, *L. Curtisii*, is figured in Hooker's *Icones Plantarum*, t. 1607. Living examples of *L. carnosa* are now in cultivation at Kew for the first time, thanks to the exertions of Mr. C. Curtis, assistant superintendent of Forests, Penang, whose interesting account of how he obtained them is given in the following letter :—

Botanic Gardens, Penang,
12th July 1894.

DEAR SIR,

BY the S.S. "Bombay," which left day before yesterday, I shipped one W. Case containing four big pieces of the Perak *Lecanopteris*, which you asked for some time ago, and a few other things to fill up the case. This is the very first opportunity I have had of getting this plant, and I hope you will receive it alive. I cut off the portion of the tree on which it was growing, so that it is as thoroughly established as it is possible to be, and I was fortunate enough to find the "Bombay" sailing the day after my arrival in Penang. If it does not survive this time, and I am not very sanguine, I am afraid we shall never succeed in getting it home alive. I cannot grow it in Penang. Why? Probably the ants are necessary to its very existence.

It is a very unpleasant plant to collect, as the little beasts are most pugnacious. It grows on the highest and most exposed portions of the hills (elevation 5,000 to 6,000 feet). In one of the pieces you will find a pretty little *Æschynanthus* that is new to me, and one or two other curious things, but the fact is I had not much time to look at them. I left Penang on the 6th to act as judge at the Perak show on the 7th, and had to return to Penang on the 9th, so that my only chance of getting the plant was one clear day. I started early on Sunday morning and got up to the top soon after mid-day, collected the plant and got back to a bungalow about 2,000 feet down and slept there. The following morning I started at 5 a.m. to catch the boat for Penang, and on Tuesday by noon the case was on the way to England. I think this is a record in plant collecting, in this part at any rate. I collected some other things which are not in a condition to travel at present.

Your obedient servant,
C. CURTIS.

Interesting Cryptogams.—During September the minute alga *Anabæna Flos-aquæ*, Kutz., and *A. Hassalli*, Nord., have occurred in immense numbers, forming a verdigris-green layer on the surface of the pond in front of the Palm House at Kew. *Hydrodictyon utriculatum*, Roth., popularly known as the "water-net," has also been very abundant in the lake.

Amongst fungi, two of the largest and most beautiful of European agarics, *Lepiota Friesii*, Lasch., and *Agaricus augustus*, Fries., hitherto only doubtfully recorded for Britain, have occurred in the Arboretum. The last-named is closely allied to the common mushroom, *Agaricus campestris*, Linn., but differs in growing in clusters; also in its much larger size and superior flavour.

Korarima Cardamom.—The plant furnishing Korarima cardamoms appears to have never been seen by botanists or to have been described botanically, though Pereira proposed for it the name of *Amomum Korarima*. There are specimens of dried fruits in the Kew Museum, received from Bombay and Aden through the Indian Museum, from Abyssinia (Countess of Mayo), and from the late D. Hanbury. The few facts of the history of this Cardamom are given in Flückiger and Hanbury's *Pharmacographia* (Second Ed., pp. 650–1):—"The Arab physicians are acquainted with a sort of cardamom called *Heil*, which was later known in Europe, and is mentioned in the most ancient printed pharmacopœias as *Cardamomum majus*, a name occurring also in Valerius Cordus and Mattiolus. Like some other Eastern drugs, it gradually disappeared from European commerce, and its name came to be transferred to *Grains of Paradise*, which to the present day are known in the shops as *Semina Cardamomi majoris*. The true *Cardamomum majus* is a conical fruit, in size and shape not unlike a small fig reversed, containing roundish angular seeds, of an agreeable aromatic flavour, much resembling that of the Malabar cardamom, and quite devoid of the burning taste of grains of paradise. Each fruit is perforated, having been strung on a cord to dry; such strings of cardamoms are sometimes used by the Arabs as rosaries. The fruit in question is called in the Galla language *Korarima*, but it is also known as *Gurági* spice, and by its Arabic names of *Heil* and *abhal-habashi*."

As the plant furnishing Korarima Cardamoms appears to be indigenous over the whole mountainous region of Eastern Africa from the Victoria Nyanza to Abyssinia, it may soon be possible to obtain fresh seed or rhizomes in order to cultivate it in this country. We hope European travellers in Eastern Africa will make a note that the plant of Korarima Cardamom is at present a much desired acquisition at Kew.

Coco-de-Mer.—The Museum of the Royal Gardens is already in possession of a fine set of specimens illustrating the mode of germination, habit, and economic applications of the Coco-de-Mer (*Lodoicea sechellarum*). One of the features of this collection is the series of fruits, which range from the usual bi-lobed form to three, four, five, and six-lobed. A very fine example of this latter form, which is in fact a triple fruit in which three nuts are developed, has just been presented to the Museum by the Marquess of Ripon, to whom it was given by H.H. Abdullah, ex-Sultan of Perak.

Index Kewensis: Fasciculus iii.—The editing and printing of this valuable work have so far proceeded without hitch or interruption, and if all continues to go well we may look for the fourth and concluding part six months hence at the latest. Part 3 comprises 640 pages, and carries the "Index" from *Kablikia* to *Psidium*. It appeared about the middle of October. Upwards of 250 pages of the fourth part are already in type. It may be mentioned, too, that the manuscript is bound as the printing proceeds, and will be preserved at Kew. This is of all the more importance, because it includes a large number of garden names, or names published without descriptions or with inadequate descriptions, which it was not considered desirable to include in a purely botanical work, though the references are of great use in tracing and naming cultivated plants.

Trees and Shrubs of the Bombay Presidency.—Mr. W. A. Talbot, F.L.S., Deputy Conservator of Forests, has compiled what he modestly entitles a systematic list of the trees and shrubs and woody climbers of the Bombay Presidency. Sind and North Kanara are included, and are referred to separately by name throughout the book. It is, however, very much more than a list, as it contains brief descriptions of the orders, genera, and species, together with references to Hooker's *Flora of British India*, to Brandis's *Forest Flora*, and to other important works. There are also keys to the orders, genera, and species. Of course, the real merits or defects of such a book are discovered by using it; but from a cursory examination it appears to have been prepared very carefully, and it is certainly singularly free from typographical errors. The arrangement, paper, and typography are good; and the book is certain to prove useful, and will probably promote the study of botany by forest officers. The author expresses a hope that it may form the framework of a future Forest Flora of the Bombay Presidency.

Flora of Macquarie Island.—This, the most southerly of the New Zealand outlying islands, is situated in 54° S. lat., and previous to 1880 only about half a dozen vascular plants were known from thence, sent by Charles Fraser. Towards the end of the year 1880 Dr. J. H. Scott, of the Otago University, visited the island, and increased the number to 19, including two such conspicuous plants as *Stilbocarpa polaris* and *Pleurophyllum criniferum*, which also inhabit the Auckland and Campbell Islands, and the former the mainland of New Zealand. Another interesting plant, and one of the commonest, is *Azorella Selago*, which has not been found in the New Zealand Islands, but has a westward distribution in the Marion, Crozets, Kerguelen, and Heard Islands, and in Fuegia.

Mr. Thos. Kirk has recently sent to Kew six additional flowering plants from the same source, collected by Mr. A. Hamilton. They are :—*Ranunculus crassipes*, a Kerguelen plant; *Callitriche antarctica*, *Deschampsia cæspitosa*, in a depauperated condition; *Festuca*, sp. *Agrostis antarctica*, *Uncinia compacta*, var. *nervosa*; and a small seedling of *Epilobium nummularifolium* attached to the roots of the last. Fragments of the following mosses and liverworts were found attached to the other plants :—*Bartramia affinis*, *Thuidium furfurosum*, *Cheiloscyphus australis*, *Jungermannia rotata*, *Lophocolea bidentata*, and *Polyotus magellanicus*, besides an indeterminable *Campylopus?* and a *Jungermannia*. Mr. Kirk writes that the total number of species of vascular plants now known to inhabit Macquarie Island is 30, several of which, however, have not come under observation at Kew.

We have also one more addition to the vascular plants of Macquarie Island, namely, *Lycopodium Selago*, which was attached to the same sheet of paper as the original specimen of *Azorella Selago*, sent by Charles Fraser. This widely dispersed lycopod is not known from any of the other islands south of New Zealand.

Flowering of Camoënsia maxima in England.—Through the courtesy of Mr. William Bull we have seen a flower of this gorgeous climber from the first inflorescence, we believe, produced in Europe. *Camoënsia maxima* was one of the numerous important discoveries made by the late Dr. Welwitsch during a long residence in Angola. It is a member of the *Leguminosæ*, and was first described and figured in 1865, in the *Transactions of the Linnean Society* (vol. xx., p. 301, plate 36). The flowers of Welwitsch's original specimens, represented in the plate cited, are just about a foot long, and the largest in the natural order. These specimens were collected at Golungo Alto, a little north of the River Cuanza. Subsequently Mr. and Mrs. Monteiro sent specimens to Kew from Quiballa, a place situated about sixty miles inland from Ambriz; and Mr. H. H. Johnston from the Congo, below Stanley Pool Both of these specimens have shorter flowers, as well as the cultivated plant; but the beauty of the flower resides in the broad frilled petals. Mr. W. Mackie, gardener to Mrs. Ruddle, The Mythe Castle, Tewkesbury, is the successful cultivator of the *Camoënsia;* and he writes that the edges of the white petals are at first of a bright golden yellow, changing to old gold on the full expansion of the flowers The plant in question produced only one raceme of four flowers. Mr. Monteiro, who figured and described the *Camoënsia* (*Angola and the River Congo*, vol. i., p. 177), sent seeds to Kew from the locality mentioned above in 1873; and a number of plants were raised and distributed to the principal botanic gardens and nurseries. It first flowered in the Trinidad Botanic Garden in 1882, then under the superintendence of Mr. Hy. Prestoe; and early in the present year Dr. Trimen recorded ("Gardeners' Chronicle" 3rd series, xv., p. 236) its flowering in the Ceylon Botanic Garden. Mr. W. Bull offered it for sale in 1885. We have not succeeded in flowering it at Kew yet, though we have now had it growing for twenty-two years.

Quassia as an insecticide.—The original Quassia wood was derived from *Quassia amara*, L., a small tree of Surinam. The supply, however, fell short, and the Quassia of commerce is now almost entirely derived from the tree known as Jamaica Quassia or Bitter Wood (*Picræna excelsa*, Lindl.). This is a large tree 40 to 60 feet high, with a trunk sometimes attaining a diameter of 1 to 2 feet. It has pinnate leaves not unlike an ash, hence one of its colonial names, bitter ash. The flowers are small, yellowish-green in colour, followed by small black berries. Quassia is imported into this country in billets or logs. Usually the smoothish grey bark has been removed. The wood is of a pale-yellowish colour; it has no odour, but is of an intensely bitter taste. Quassia chips are officinal in the Pharmacopœias of Britain, India, and the United States. They possess tonic and stomachic properties, and are valuable in dyspepsia and debility. Bitter cups (in which water allowed to stand acquires a bitter flavour) are made from Quassia wood. The active principle is Quassin or Quassite, which appears in small white crystals, very bitter and inodorous. It is present in the proportions of about $\frac{1}{10}$ per cent. Although an infusion of Quassia is harmless to human beings, it is remarkable that the drug acts as a narcotic poison to animals. It is used in what is known as *papier mouri* to destroy flies, and fruit and hop growers also use large quantities at certain times of the year to destroy aphides and so-called "blights." To prepare an extract of quassia on a large scale it is recommended to use very fine chips and boil them in water with soft soap. A simple infusion without soap is, however, quite as effective, and for use in green-houses the latter is preferred. Quassia water is odourless, and perfectly safe to use. In these respects it is preferable to both kerosine emulsions and to tobacco water. There is always a certain amount of risk in using kerosine emulsion even in the most careful hands, and besides, the smell is specially objectionable. If more widely known, it is probable that **Quassia extract, for delicate plants in houses,** would almost entirely take the place of tobacco water and largely also of kerosine emulsion. If sprayed regularly over the plants it would keep them entirely free from insect pests.

Coffee and Tea in Travancore.—Travancore, a native state, occupies the extreme south-western corner of India. It is very picturesque, and its vasts forests contain much teak, black-wood, ebony, and other valuable trees. The cultural resources of the State are not very widely known. The following information respecting coffee and tea is taken from a Report on the Forests of Travancore by Mr. T. F. Bourdillon, F.L.S., dated 29th December 1892 :—

Coffee :—About the year 1872 a fungoid disease (*Hemileia vastatrix*), which had attacked the leaves of the coffee plant in Ceylon some three years previously, began to appear in Travancore, and very rapidly spread through every estate in the country. As, however, the price of coffee remained high, and "the leaf disease," as it was called, seemed to yield to manure and careful management, extension of cultivation still went on.

After 1877 prices began to fall, until they reached a figure which could only pay those owners of estates who were getting large crops, and this the disease prevented. Under these combined circumstances, one estate after another was abandoned, and at the present moment almost the only estates still cultivated with coffee are those which had been planted on exceptionally fertile soil, or which have other advantages enabling them to yield good crops. The exports of coffee last year amounted to only 6,546 cwts. Prices of coffee are again much higher now, owing to short crops in Brazil, and it is possible that the area under that product in Travancore may be again slightly increased, but it is unlikely that there will ever be any great extension.

Although leaf disease and low prices together combined to ruin the coffee enterprise, other causes contributed to bring about that result, Much of the land planted was steep, and the heavy rain washed the soil away, other parts were exposed to wind, or contained poor soil, while nearly everywhere the coffee plants were hurriedly planted out without a proper rejection of the weak and sickly specimens. Indeed those who have studied the question are generally agreed that the leaf disease was a result rather than a cause, and that it would never have have done the damage it did, unless the coffee plants had been already in a sickly condition, a belief that is supported by the fact that in Coorg where the soil is good and cultivation receives due attention, leaf disease is little feared.

Tea :—The tea plant was introduced into Travancore by General Cullen many years ago, but it was not until 1876 or 1887 that any efforts were made to extend its cultivation. The first attempts proved so successful, that a large area has now been planted up, and some extensions are made every year. The annual out-turn must be nearly a million lbs. of made tea, but there are no statistics on the subject available. The area under tea is probably about 3,000 acres.

The tea plant is found to thrive equally well at sea level and at 6,000 feet. In the former situation it is difficult to start on account of the drought ; and the greater heat causes it to winter more thoroughly, but during the monsoon months the growth is remarkably rapid, and fully makes up for its cessation in the dry weather. At the higher elevations the growth is more regular, but less rapid, and the yield less, but quality is better, so that the advantages of either situation are about equally balanced. Probably the best elevation is about midway between the two at about 3,000 feet. It was here that the first success was secured, and here a very considerable yield can be obtained, while the climate is more favourable for Europeans than in the low country.

The present position of the tea industry in Travancore is decidedly encouraging. The yield is good and the class of tea is on a level with that of Ceylon. The mistake of planting steep lands, made in the case of coffee, has been avoided, and the plants have been singularly free from diseases or attacks of insects. Only one or two of the estates at lower elevations have suffered from the tea mosquito (*Helopeltis Antonii*), which punctures the leaves and prevents the plants flushing. The low prices now ruling, which are the result of extended cultivation, do not admit of large profits, but it is nevertheless possible to obtain a very fair return on the capital expended.

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 96.] DECEMBER. [1894.

CCCCXXV.—CULTURAL INDUSTRIES IN DOMINICA.

Dominica (*Kew Bulletin*, 1891, p. 115), is the largest and most southerly of the Leeward Group in the West Indies. It contains 291 square miles, and has a population of about 29,500. The principal town is Roseau on the south-west coast. The surface is very mountainous, and abundantly clothed with vegetation, and in almost every valley there is a clear running stream of water. The climate, for the tropics, is generally cool and pleasant. The rate of mortality is 15·6 per 1,000. The rainfall is abundant and regular. All the high elevations are covered with virgin forests, and only about 20,000 acres out of a total of 186,436 acres are now under cultivation. In fact, this beautiful and fertile island is quite undeveloped.

A full account of the fruits of Dominica, by Dr. A. Alford Nicholls, F.L.S., was published in the *Kew Bulletin*, 1888 (pp. 197–214). A general review of the island and its agricultural resources was given by Mr. Morris in the report of his mission to the West Indies in 1890–91 (*Kew Bulletin*, 1891, pp. 115–119). In this report was also included a description of the steps taken to start the Botanic Station at Roseau. Information of a later date respecting the work of the station is given in the *Kew Bulletin*, 1893 (pp. 148 and 359). Since that time the affairs of Dominica have occupied a good deal of attention. A Report of the Royal Commission appointed September 1893, to inquire into the condition and affairs of the island of Dominica has lately been communicated to Kew by the Secretary of State for the Colonies.

Colonial Office to Royal Gardens, Kew.

Downing Street,
3rd November 1894.

Sir,

I am directed by the Marquess of Ripon to transmit to you a copy of the recently published report of Sir. R. G. C. Hamilton upon the island of Dominica.

u 85017. 1375.--2/95. Wt. 45. E. & S.

His Lordship is glad to observe that the valuable services rendered by your department to the West Indies are noticed by Sir R. Hamilton on pages 14 and 15 of his report.

I am to add that a copy of this letter will be sent to the First Commissioner of Works.

I am, &c.
(Signed) EDWARD WINGFIELD.

The Director, Royal Gardens, Kew.

In this report Sir Robert G. C. Hamilton, K.C.B., the Royal Commissioner, has presented a very complete account of the condition of the colony. The portion which deals with the natural resources of the island and the means whereby they might be more fully developed, deserves the greatest attention. The following extracts bear directly upon the work undertaken by Kew in endeavouring to encourage a wider range of cultural industries in the West Indies :—

Dominica is undoubtedly a most fertile island, and suitable for raising almost every description of tropical produce. Very strong evidence was given to this effect by Dr. Nicholls, who speaks with authority on this matter, being himself the author of a text-book on tropical agriculture which is the standard work on the subject. Rather more than 100 years ago the island was very prosperous. Her main product then was coffee, of which the annual export amounted in some years to between four and five million pounds weight. But this prosperity did not long continue. In the closing years of the last century many of the planters, who were French, were hostile to British rule, and political disturbances were frequent. These disturbances led to the deportation of many French residents, and the numerous serious outbreaks and depredations of runaway slaves caused other planters to leave the island and abandon their estates, or place them in the hands of attorneys, who often mismanaged them. These causes seriously interfered with the staple industry of the island, and its output diminished. Another cause which operated in the same direction was the denudation of the forest-lands, which was going on in some of the western districts of the island, where coffee was principally grown. This injuriously affected its cultivation, especially on steep hillsides. Moreover, as a rule, manure was not used at all, or only in insufficient quantities, and the soil of many of the earlier plantations consequently became exhausted. Then, early in the present century, an insect blight made its appearance in the coffee plantations, and inflicted considerable ravages, and in 1834 a hurricane occurred which created great havoc among the trees. The high price of sugar, meantime, induced many of the coffee planters to root up their coffee trees and to plant canes. But the result, as a rule, was not successful, for where coffee had grown well, planters often failed to grow sugar, as the same soils and situations are not suitable for the growth of both these products.

Afterwards came negro emancipation, and with it the impossibility, in many cases, of obtaining sufficient labour at the right moment for taking in the crop. These causes all combined practically to extinguish the coffee cultivation of the island. Owners finding their estates unprofitable, got rid of them as best they could. Some few sold them, generally for small sums, and to persons without adequate capital to work them. Others divided them up among their connexions or dependents or former slaves. Some abandoned them altogether, and the peasantry appropriated them. Thus the class of peasant proprietors arose, and they turned their attention mainly to the supply of what are called "provisions" in Dominica, that is, cassava, arrowroot, plantains, bananas, yams, &c. In this way they raised sufficient food for their own maintenance, and having few wants which necessitated the use of money, they practically abandoned the cultivation of coffee altogether.

As the coffee cultivation decreased sugar cultivation was advancing, but it never flourished like the old staple product of the island. Still so long as the price of sugar kept up there was a certain amount of prosperity in the island; but now that it scarcely pays the expense of cultivation, unless under the most favourable conditions of soil and situation, many sugar estates have been abandoned, large numbers of people have been thrown out of employment, and the island is in a depressed condition.

Many planters still pin their faith to the cultivation of sugar, and hope against hope that brighter times are in store for this industry, out of which so many fortunes were made in the old days. They contend that foreign countries cannot always go on granting bounties, and that, besides, the consumer must, in time, come to recognise the superiority of cane to beet sugar, and that when he does, prosperity in this industry will revive. I am not without hope in this direction, but Dominica has not much land relatively to her area suitable to the cultivation of canes, which can only be profitably grown in the valley beds and surfaces low down, or of moderate undulation. Hope for the future of Dominica, therefore, in my view, lies mainly in the extension of other cultivations. It is the adaptability of her soil to the production of many different articles in constant use and demand that can be made to place her agricultural interest on a broad and solid basis, and should relieve her from those painful vicissitudes to which agricultural communities are subject whose existence depends on the output of one description only of marketable produce. It is quite true that no other cultivation affords the same employment to the labouring population as the cultivation of sugar does, but there is plenty of room and to spare in Dominica for the settlement on the land of all the labourers who are now out of employment.

I think what I have said above accounts to a great extent for the backwardness of the island, when compared with the other West Indian Islands, a point to which special reference was made in the Secretary of State's letter of instructions to me. But there is another cause also at work in the widespread feeling of discontent with their condition which undoubtedly exists at the present time in the minds of the people. Some witnesses attributed this to recent inflammatory writings and speeches, but these I regard rather as a symptom than the seat of the disease. But, while it is admitted that discontent is not a congenial soil for the growth of the prosperity of the people, it may be asked why, in spite of this, some improvement is not being effected in the economic condition of the island, and why, if Dominica is so fertile, the coffee industry is not revived, and other remunerative industries introduced for which the island is suitable? My answer is that something is being done in this direction. The cultivation of limes and cocoa is now considerable in the island, and is extending. There was a serious failure of the cocoa crop in 1892–3. But the export returns show that, while the output fluctuates from various causes, on the whole it is annually increasing. The lime crop also is steadily increasing, and although some witnesses expressed a fear that the supply of this product might exceed the demand, when it is borne in mind that there are three distinct articles produced from the lime—citric acid, lime juice, and essential oil of limes—I do not think there is any cause for alarm that the production of limes of the quality grown in Dominica, which is the best in the world, will ever cease to be a remunerative industry.

Coffee, too, is being planted, though not to the extent it ought. The kind known as Liberian, which is never affected by blight, and which has the advantage of being easily gathered, as it ripens gradually instead of all at once like the Arabian coffee, is being introduced on the lower grounds, while Arabian coffee, the old coffee of the island, is being introduced at the higher elevations, where the effect of the blight upon it is never serious. The substitution of one sort of cultivation for another, however, is a matter of time. Cocoa trees are not in full bearing until seven years after they are planted, limes until ten years, and coffee until from four to six years, according to the elevation at which the trees are planted, and, to some extent, also to their exposure. A progressive output may, therefore, be constantly expected from these cultivations, but it must be borne in mind that Dominica is a place mainly of small proprietors, who owe their origin to the circumstances in her history that I have described, and that a great barrier to her progress exists in the want of knowledge of the people. They speak a patois which is not a written language, and most of them can neither read nor write. As I have already said, many of the small holders of land cultivate nothing but "provisions," and they used to supply their small money wants by selling any surplus beyond what was consumed by themselves and their families. There never was much of a market for "provisions," but now that many sugar estates have gone out of cultivation, and few people have any money to spend, there is scarcely any market at all. Obviously what these small holders should do, and what they are beginning to do, is also to cultivate some of those other products I have referred to, for which there is always a market. But it takes time for these poor people to appreciate the necessity of doing this. Then, again, they know little of the best methods of cultivating cocoa, limes, and coffee, nor have any effective steps been taken to instruct them on this matter. It is true that the present Governor of the Leeward Islands, Sir William Haynes Smith, has established a botanical station at Roseau, at which plants of these trees can be purchased at a small cost, as well as plants of oranges, in which a large trade with England might be developed, kola nuts, spices of various sorts, and medical herbs, for the cultivation of which many parts of the island are peculiarly suitable. This I regard as a matter for which he is most highly to be commended.

It is impossible to over estimate the value of the assistance which our colonies in such matters receive from the authorities at Kew Gardens. In fact, but for their action in directing attention to the benefits to be derived from the establishment of botanical stations, I doubt whether any of those stations would be in existence at all. Kew, moreover, not only lends her powerful aid in inducing Colonial Governments to introduce such stations, but she also finds curators for them, supplies them with plants, and is always ready to give counsel and advice, from experience collected from all parts of the world, as to the descriptions and methods of cultivation most suitable for the different colonies, and the most approved ways of preparing the various products and putting them into their most marketable shape. The colonies themselves are fully alive to the value of the services that Kew renders to them in the development of their resources, but I doubt whether the important part that she plays in such matters is fully known in this country, or is appreciated as it ought to be.

In Dominica, however, though the evidence of the curator of the botanical station at Roseau shows that the demand for plants is rapidly increasing on the part of the owners of the larger estates, it is doubtful whether many of the smaller proprietors are even aware of the existence of the Botanical Station. Every means possible should be taken of making this known to them, and of urging upon them the necessity of cultivating something besides "provisions." They should be instructed as to the soil, situations, and exposures best suited for the cultivation of cocoa, limes, and coffee respectively, and of other remunerative products, such as nutmegs, ginger, sisal hemp, &c. They should be made acquainted with the best methods of preparing the ground for the reception of those plants for which it is most suitable; with the distances that trees of each sort should be planted apart, which differs even with the same description of cultivation on steep and on flat surfaces; with the best ways of sheltering such of them as require shelter; with the best ways of pruning the trees; and of gathering and preparing the produce for market. Notices containing this information should be spread freely throughout the island. The district government officers should be required to explain and disseminate this information as widely as possible, and the good offices of the priests and schoolmasters in every parish should be enlisted in the same direction, and I believe their co-operation would be heartily given. If this were done a marked improvement would soon be visible in the island.

The following evidence was taken in regard to the work of the Botanic Station:—

(Extract.)

Mr. J. Jones, curator, Botanical Station.

Rears plants for sale at a small cost, mainly cocoa, coffee of two sorts, Liberian and Arabian, kola nuts, vanilla, spices, limes, oranges.

The demand has chiefly been for coffee plants this year, last year it was for limes.

Cocoa pods for seed are obtained from Montserrat.

The charges made simply cover the cost of seed, the rest is found by the Botanical Station.

The larger cultivators take the majority of the plants.

Cannot say if all small cultivators know of the advantages of the station.

Will sell as little as one plant.

Has not been able to supply the demand, which is increasing, as the funds at his disposal are not sufficient.

Has plenty of space in which to extend his operations.

Montserrat cocoa obtains a higher price than Trinidad cocoa.

Small cultivators chiefly take limes.

Cocoa plants are 2*s*. 6*d*. per 100 in bamboo pots.

Price for cocoa is 6*d*. per pod, the price given in Montserrat.

Cocoa is delicate in the young state.

Has sent out about 2,000 orange plants this year of the indigenous plant, but hopes to get a better plant.

Does not use manure.

Good natural manure is far better than artificial.

Has to send weekly and monthly reports to Mr. Barber at Antigua.

Any demand over 1*l*. has to go to Antigua to be signed by the Governor.

Has six men and six women working in the gardens, and two men in the nursery.

The previous curator sent out 9,000 plants in 1891.

This year the station has already sent out over 20,000.

Has never had complaints as to plants sent out; as a rule the plants have done well.

There is now a great demand for Liberian coffee.

CCCCXXVI.—GERMAN COLONIES IN TROPICAL AFRICA.

In a Foreign Office Report [No. 346, Miscellaneous Series, 1894] on the "German Colonies in Africa and the South Pacific" lately forwarded to Lord Kimberley by Mr. Martin Le M. Gosselin, C.B., H.M. Chargé d'Affaires at Berlin, some interesting particulars are given respecting the development of agriculture under German auspices in Tropical Africa. The principal items are contained in the following extracts:—

TOGOLAND.

This is the first German Colony on the West Coast of Africa. It lies immediately east of the British Colony of the Gold Coast and between it and the French Colony of Dahomey. The estimated area is 60,000 square kiloms. The population is said to number two and a half millions. Of these, in 1893, only 56 were Europeans. The port of the Colony is at Klein Popo. Lome is also a thriving town with 14 factories or European trading houses. "Togoland, from a financial point of view, is the most satisfactory of all the German Colonies. It is indeed, the only African Colony which pays its way without asking for a subsidy from the Imperial Government."

"The chief products of the Colony are:—

"*Palm-oil. Palm-kernels. Cocoa-nuts.* These were planted until quite recently only for the consumption of the natives; latterly the cultivation has much increased. The Europeans have planted from 60,000 to 70,000 trees, and the natives are following their example.

"*Indian corn* is grown in large quantities, but little is exported, as most of the crop is wanted for home consumption. A considerable quantity, was, however, sold last year to the French Commissariat for the supply of the troops engaged in the Dahomey war.

"*Ground nuts* are now only planted in small quantities almost exclusively for native consumption.

"*Caoutchouc* grows well on the hills in the interior, and it is intended to plant a large quantity of indiarubber trees.

"Trees resembling *mahogany*, and in less quantity *ebony*, are to be found in the forests along the Haho and Sio Rivers.

"Oranges, lemons, figs, pine-apples, melons, yams, and bananas, pepper, and tomatos are all to be found in Togoland, and an attempt is now being made to rear the cotton-plant. The coffee plantations are doing well, and the first coffee harvest will be gathered this year. Very successful experiments have been likewise made in arboriculture, *Eucalyptus* and mango trees thriving particularly well. As for vegetables, salad, radishes, turnips, parsley, and asparagus are successfully cultivated. Potatoes on the contrary are not a success."

CAMEROONS.

The Colony of Cameroons is situated in the Bay of Biafra opposite the Spanish Island of Fernando Po. Before the recent agreements with England and France the area of this Colony was estimated at 413,000 square kiloms. The coast region is composed of primeval forest with a fruitful and rich soil, but unhealthy for Europeans. Adjoining this is a high-lying, grassy, thickly-populated, tableland, with a cool temperature and a healthy climate. Beyond is the unexplored hinterland forming the basins of the Upper Nyong and Upper Ngoko in the south-east of the Colony. The future prosperity of the Colony is said to depend on the development of the interior portions and the encouragement of trade with native states. The agricultural condition of the Cameroons is described as follows:—

"The chief productions of the Cameroons are:—

"*Palm-oil*, the staple production of the Colony.

"*Palm-kernels* and *Palm kernel-oil*, a good clean oil, chiefly consumed by the natives, and seldom coming into the markets.

"*Kopra*, the dried kernel of the cocoa-nut; a great many plantations have been made.

"*Indiarubber*, found in all parts of the Colony, but chiefly in the highlands. Experiments are being made under Dr. Preuss, the Director of the Botanical Garden at Victoria, with the Brazilian rubber tree (*Hevea brasiliensis*); some of the imported trees are already 4 to 5 metres high, and if they continue to thrive in the Cameroons they will be of great advantage to the Colony as they yield the best rubber in the world.

"*Ebony*, chiefly found in the Cameroons Mountains.

"*Mahogany* and other *timber*, the export trade of these articles is mostly carried on by Swedes in sailing ships.

"*Ivory*, of which there is a plentiful supply, especially from the neighbourhood of the Mungo and Sannaga Rivers and the Batanga Hinterland.

"*Cacao*, the cultivation of which is being largely extended, though the plants are still too young for a large yield; one plantation raised in the year ended July, 1893, 200 kilos. cacao, and the Ambas Bay Trading Company exported 6,928 kilos.

"*Coffee* plantations are thriving well, 12,000 Arabian coffee trees have been planted in the Victoria district, also trees from Liberia and Jamaica; three year old plants have already borne a very heavy crop.

"*Tobacco*, 6,500 kilos. were produced last year, realising an average price of *5s.* per lb.

Experiments, so far satisfactory, are being made in the Botanical Garden for cultivating vanilla, pepper, Jamaica ginger, cardamoms, ipecacuanha, and European vegetables.

"The natives confine themselves, as a rule, to the cultivation of bannanas, cacao, maize, sugar-canes, oranges, and pine-apples."

The exports in 1893 were valued at 206,250*l.*, consisting of palm-oil, palm-kernels, gum, ivory, and ebony. The trade is still carried on to a great extent by barter, money not being of much use except in the coast towns.

GERMAN EAST AFRICA.

German East Africa, the creation of Dr. Carl Peters, is an extensive tract of country covering 955,220 square kiloms. It has a coast line opposite Zanzibar of about 360 miles and extends inland as far as Lake

Victoria Nyanza on the north and Lakes Tanganyika and Nyassa and the Stephenson Road on the west.

The only item of special importance from an agricultural point of view from German East Africa is the occurrence on the newly planted coffee areas of the well-known but destructive coffee-leaf disease of Ceylon (*Hemileia vastatrix*).

In the *Kew Bulletin*, 1893, p. 361, correspondence was published on the subject of preventive measures to be adopted in British Central Africa for keeping out this disease from the coffee plantations in the Shire Highlands. The need for these measures is now greatly enforced by the calamity which has overtaken the German plantations to the north. Mr. H. H. Johnston, C.B., regarded the "introduction of the leaf disease "of Ceylon into the coffee plantations of Central Africa as likely to ruin "the commencing prosperity of the country." There is no doubt the disease is in German territory. Specimens of diseased coffee leaves were forwarded to Kew by the Deutsch-Ostafrikanische Gesellschaft and at its request and expense a telegraphic message was sent to Africa confirming the suspicion that the disease was *Hemileia vastatrix*. Mr. Gosselin states :—

"The Ceylon coffee disease has unfortunately been discovered this season in East Africa. Every effort is being made to exterminate it, but if it spreads it will naturally throw back the cultivation of what promised to be one of the most successful crops in the Colony."

CCCCXXVII.—SISAL HEMP IN THE BAHAMAS.

The gradual development of the Sisal hemp industry in the Bahamas continues to be watched with a good deal of interest. It is now in a position when exports of prepared fibre have begun to be made and its value quoted as a regular article of commerce. An important statement on the subject (in continuation of that in *Kew Bulletin*, 1894, p. 189) is contained in the following extract from the Annual Report on the Bahamas for 1893, submitted by the Governor, Sir Ambrose Shea, to the Secretary of State for the Colonies [*Colonial Reports*, Annual, No. 110, 1894.]

The export of Bahama hemp amounted in 1893 to 1,200*l.* as against 692*l.* in 1892. The area of Crown land now disposed of is 85,000 acres, while about 15,000 acres of private land is also in course of cultivation. The quantity planted at the end of 1893 was 17,000 acres, and an annual increase of about 6,000 acres will be the rate of progress. The history of the origin and growth of this industry has so often been written that but little remains to be said in that regard. It will, hereafter, be a record of increasing development and social advancement which results now appear to be as assured as is possible in the course of human events. As far as the welfare of the Colony is concerned there seems to be the minimum of uncertainty, for it is not conceivable that the value of the fibre can go below the cost of production, though the profit, as in the case of all commercial enterprises, must ever be an uncertain and varying quantity. The export of 1893 was far below the expectations, though not from want of an ample supply of the raw material.

The shortcoming was due to several causes. In the first place the most advanced plantation, in which an American syndicate is interested, was almost entirely neglected owing to the financial troubles in the United States, and the low price of the fibre, consequent in a great degree on the money stringency which lessened the desire to prepare the product for market. The business was also much delayed by disappointment in the matter of the scutching machines, which in many cases proved useless. It is highly satisfactory to know that this difficulty is now over, for a machine manufactured by the Todd Company of New York has been at length found to work admirably, the fibre being cleaned perfectly, at the smallest possible amount of waste (*Kew Bulletin*, 1894, p. 189). There can be but little doubt that this machine will be universally adopted, as, besides its efficiency, it is cheaply operated, a woman to feed the machine with leaves, another to remove the finished fibre, being all the labour attendant on this process. It has been for some time a subject of much thought as to how the small cultivators were to utilise their labour where, as in the great majority of cases, they were too poor and their plantings too limited to admit of the cost of a machine. A satisfactory solution, however, has now been found which will be a great boon to this class and will bring the blessings of the industry home to the humblest peasant in the Colony. The process is as simple as it is available to all, and consists of a slit being made in the thick end of the leaf, when it is torn asunder, leaving the inner part exposed, and by then soaking it in salt water, which is never far to reach, in about a week the pulp may be removed by hand and the fibre preserved. No waste whatever is found in this method ; and it is understood that a man or woman, or grown boys or girls, may turn out from 50 to 60 pounds of fibre as the result of a day's work. The plan is being adopted throughout the Colony, and what was for some time deemed a missing link is thus effectively supplied.

There has always been a certain amount of speculation as to the effects of hurricanes on the fibre fields, and though the plants are so hardy, the idea was in some degree a disturbing one. The question has now been satisfactorily tested. In August last, as well as in October, the Bahama Islands were visited with hurricanes which did considerable damage to various kinds of property. In one or two cases fibre fields, by unusual rising of the tides, were laid under water, and it was supposed that in these instances much injury had been done to the plants. In all other fields, though exposed to the force of the storm, the plants escaped without any injury and their power of resistance was thus established. But even in the submerged fields, the damage proved eventually to be trifling. The leaves were much knocked about, but they finally recovered to a great extent, and they are now being dressed, producing a fibre not much inferior to the best, but classed as No. 2, because of some small spots being discoloured which detracts from the appearance, though not, it is believed, from the strength of the article.

Labour continues in good supply and is not likely to be a cause of difficulty for many years. Railways are being laid down in the principal estates, and this will be found a most profitable investment in saving labour on the carriage of the leaves to the dressing establishment, 100 pounds of leaf yielding not more than four or five pounds of fibre. Of the large plantations one has over 5,000 acres under cultivation, one about 3,000, one 2,000, and two others 1,000 acres each. The smaller farms are from 200 to about 700 acres. Now that a standard scutching machine has been accepted exports should go forward moderately in 1894, but on a large and increasing scale in the following and future years.

The generally accepted standard of 600 plants to the acre, is now in many cases being changed to 800 and in some instances to 1,000. If this increased number be not found to impede harvesting by the inconvenient crowding of the plants, the yield per acre should, of course, be largely augmented. The estimated annual yield of a single plant is two pounds of fibre, and thus, instead of a return of 1,200 lbs. from the earlier planting of 600 suckers, assuming that the results are not modified by want of room for the full development of the plants, 2,000 lbs. will be the expected yield where 1,000 plants are given to the acre.

(Signed) A. Shea.

CCCCXXVIII.—SAGO CULTIVATION IN NORTH BORNEO.

(*Metroxylon Sagu*, Rottb. *Metroxylon Rumphii*, Mart.)

The sago of commerce is a kind of starch prepared from the soft internal stems of certain palms natives of the Malay Archipelago, Borneo, New Guinea, and possibly of Fiji. The word sago or sagu is said to be Papuan for bread.

There are two well-recognised species of sago palms. The smooth or spineless sago palm (*Metroxylon Sagu*) is specially abundant in Sumatra and adjacent islands. It does not reach so far eastward as New Guinea. In North Borneo it is known as *rumbia benar.* Wet rich soils, especially at the base of mountains, are its favourite localities. This species is regarded as the principal botanical source of the sago received in Europe.

The thorny sago palm (*Metroxylon Rumphii*) is found further east than the other species. It is plentiful in New Guinea, and in the Moluccas and Amboyna.

Both sago palms resemble each other in general appearance, but the latter is a smaller tree, and it has its leafstalk and the sheaths enveloping the lower part of the flower spikes armed with sharp spines from ½ an inch to about 1 inch long. It has, moreover, decided littoral tendencies, and is abundant along the shores of many small islands forming a dense impenetrable belt. In North Borneo the thorny sago palm is known as *rumbia berduri* or *rumbia salak.*

Some sago is obtained from the sugar palm (*Arenga saccharifera*) after the plant is exhausted of its saccharine juice. The sago palm of India is *Caryota urens.* The farinaceous part of the trunk of old trees is said by Roxburgh to equal the best sago from the Malay islands. In China, Japan, and Florida, sago, differing in character of the starch grains from palm sago, is obtained from species of *Cycas* such as *C. revoluta* and *C. circinalis.* The commercial importance of the latter is very slight.

The cultivation of the true sago palms is entirely confined to the Eastern Archipelagos. The plants are difficult to grow elsewhere, and it is improbable that the industry will extend beyond its present limits. Both species of *Metroxylon* are monocarpic and die after the seeds are ripened. The life of the plant lasts for about 15 to 20 years, at the end of which period the terminal inflorescence is formed. In spite of the abundance of flowers very few fruits are produced; these occupy two or three years in ripening. The propagation of these palms is usually affected by means of suckers or stolons formed round the base of old trees.

An interesting account of sago cultivation in Province Dent in British North Borneo is included by Governor Creagh, in the report on the Blue Book of Labuan for 1893. [*Colonial Reports*, No. 122, Annual 1894.] As the subject has not hitherto been dealt with in these pages the report which has evidently been carefully prepared on the spot by Mr. J. G. G. Wheatley is reproduced for general information:—

A REPORT ON SAGO CULTIVATION IN PROVINCE DENT.

The sago palm, from which is manufactured the well-known sago flour of commerce, resembles in appearance the cocoa-nut tree. The former is valued for its trunk alone, the nuts are useless, and the tree dies if allowed to fruit.

Varieties of Sago Palm.

1. There are only two kinds of sago palm which are cultivated, the "rumbia benar" (true sago), and the "rumbia berduri" (the thorny sago), also known as "rumbia salak." In appearance, both are the same, but on close inspection the stems of the latter, to which the leaves are attached, known as "pallapa," will be found to be covered with bunches of thorns about 1½ to 3 inches long.

Mode of Planting.

2. Sago grows chiefly on damp ground subject to floods at certain times of the year. If grown in swamps, less sago is produced and the trunks do not attain as great a height as when planted on clayey damp soil subject to floods periodically. Once planted, the tree withstands floods and brackish water, but in the latter it does not grow as fast and the trunks are small. Sago is planted chiefly by suckers sent out by the parent tree which are carefully cut off under ground. In swampy ground, the shoots are planted out at once, but in other localities the shoots are tied together in bundles and placed in wet, muddy ground until they have begun to send out roots, when they are planted out in holes 12 inches deep, 1 foot in diameter, and 4 to 6 fathoms apart. No earth is placed about the roots, but the plants are supported in an upright position by two sticks fixed on either side. The earth gradually fills the holes during rains and floods. One man with an assistant can plant 300 plants a day. After this, further attention is generally unnecessary for a year, and in some cases two years, when the jungle growth is cleared around the growing tree. Some planters regularly clear around the roots and cut away suckers if they are too abundant. *Rumbia berduri* is preferred to the *rumbia benar*, chiefly because the wild pigs do not attempt to destroy young plants, on account of the thorns. In planting *rumbia benar*, fences have to be made to keep out the pigs, which are very destructive. *Rumbia berduri* is also reported to produce more raw sago, but the quality of flour is the same in both species. Each tree produces from four to five pikuls of raw sago

(133 lbs.=one pikul), being at the rate of one pikul per fathom of trunk. Both trees grow to the same dimensions, 24 to 42 feet in height, and 1½ to 3 feet in diameter at the base of trunk. The sago palm is not subject to any disease, but, if a deep cut is made at the base of the trunk close to the earth, the pith is attacked by large maggots, which gradually eat their way into the centre of the tree, and in three or four months destroy the whole trunk. This is a favourite way of paying off a grudge among the natives. The sago tree takes from five to seven years to mature, according to the nature of the soil. During the third year, the plant begins to send out shoots. These grow up with the parent tree and in time give out suckers. If these are allowed to grow too freely, they form a dense thicket around the mature trunks and give a great deal of trouble to the workers. Every year, each clump produces a large number of workable trunks. During the fifth year, the parent tree is ready to be cut down. In the meantime, the young shoots are rapidly developing, and in the seventh year probably three or four trees are ready, and so on, so that the sago tree once planted continuously supplies the planter with logs without giving him any trouble as regards their cultivation. The natives compare their sago plantation to a herd of cattle, and it would be difficult to reckon the number of logs that each clump may have produced in the space of 40 or 50 years. When the sago tree is allowed to flower, the pith begins to diminish, and, if the mature trunks are not cut down regularly, the whole clump gradually deteriorates and the trees become stunted bushes instead of growing to the usual height. Nothing of the sago tree is lost. The trunk supplies the sago; the leaves and stems are largely used by natives for building purposes, the former for roofs and the latter for partitions and walls of houses, which, when properly constructed, are very neat-looking and durable. The top shoot makes an excellent vegetable, while the trunk, when split in two longitudinally and the pith scooped out, is used as a boat to transport the raw sago which has been extracted from it. Tha bark when taken off makes excellent fuel, and an enterprising Chinaman who employs an engine for rasping sago logs uses this as a substitute for fire-wood.

The sago trade between Mempakul and Labuan is carried on by native schooners of about 40 tons, which ply regularly and in fair weather are able to make a trip every two days.

The following are the figures recorded in the returns at Mempakul of the sago shipped to Labuan since January 1890:—

——	Sago Flour.	Raw Sago.
	$	$
1890 - - - - - - -	23,483.72	10,350.32
1891 - - - - -	24,826.67	18,560.20
1892 - - - - - - -	101,327.06	25,304.59
1893 - - - - -	119,092.70	25,034.24

The latter portion of the year is generally the busiest, as the rains assist in the transport of the raw material from streams which may have become too shallow during the dry weather.

The present price of sago flour at Singapore is $2.55 per pikul. The Chinese traders buy the raw material at from $1 to $1.20 per pikul, according to the market price at Singapore, and, after allowing for the cleaning of the raw sago and washing it in the factories, there remains a profit of at least 50 cents per pikul to the Chinese manufacturers. The freight from Labuan to Singapore at present is 22 cents per bag of 115 catties=150 lbs. A royalty of 6 cents per pikul is charged on sago flour exported from Province Dent to Labuan when the Singapore price is below $2.50, and 8 cents when above that sum. On raw sago, a royalty of 8 cents is charged to protect the sago factories. The sago trade is increasing rapidly on the Borneo Coast, and at the present time over three-fourths of the flour and raw sago exported from, and imported into, Labuan comes from British North Borneo ports.

(Signed) J. G. G. WHEATLEY,
Magistrate, Province Dent.

Mempakul,
September 15, 1894.

CCCCXXIX.—THE CLOVE AS A DYE PLANT.

(*Eugenia caryophyllata*, Thunb.)

The cloves of commerce are the dried unopened flower-buds of *Eugenia caryophyllata*. The tree is a native of the Moluccas, but is now cultivated in Zanzibar, West Indies, and other tropical countries. An account of the important clove industry of Zanzibar is given in the *Kew Bulletin*, 1893 (pp. 17-20). This was prepared for the late Sir Gerald Portal, and published as a Foreign Office Report [No. 266, Zanzibar, 1892]. The clove tree was introduced into Mauritius in 1770 by the French and at the end of the century an Arab named Harameli-bin-Saleh accompanied a French officer from Zanzibar to Bourbon, and obtained permission to take back a small quantity of seed and plants with him. This was the commencement of the very flourishing clove industry in Zanzibar. In 1891 there were exported nearly 14,000,000 lbs. (avoir.) of cloves from Zanzibar and Pemba. Although cloves are still cultivated in Mauritius, Seychelles, and Bourbon, the quantity exported is not appreciably large.

One of the best clove estates in the Seychelles is at Cascade. This was lately described by Mr. William Scott, Director of Forests and Gardens in Mauritius, while on a visit to the islands. The trees are well-established, regularly planted, and many are from 40 to 50 feet in height. According to the information supplied in the correspondence given below, it appears that the ripe clove fruit (called "mother clove") is used in the Seychelles for dyeing cloth. This is not an entirely new use of the product, but its merit does not appear to have been fully investigated. The material received from the Seychelles was submitted to Professor Hummel, of the Yorkshire College, Leeds. He was good enough to investigate it, and the result, which it must be admitted is not very favourable, is given in his report:—

Messrs. GOUFFÉ and JAMES to ROYAL GARDENS, KEW.

80, Bishopsgate Street Within, London, E.C.
29th May, 1894.

DEAR SIR,

WE have received from the Seychelles Islands a tin of the ripe fruit of the clove; the natives use it to dye their clothes with. Do you think they could be used, commercially, for that purpose in England?

If so, and you could put us in communication with anyone the article would be likely to interest, we should be very much obliged to you.

We send you the tin; we do not know whether you have seen any specimen of this fruit before.

We are, &c.
(Signed) GOUFFÉ & JAMES.

W. T. Thiselton-Dyer, Esq., C.M.G., &c.,
Royal Gardens, Kew.

Proffessor HUMMEL to ROYAL GARDENS, KEW.

The Yorkshire, Leeds.
November 6th, 1894.

MY DEAR SIR,

ON June 3, 1894, I received a letter and a sample of the ripe fruits of the clove (*Eugenia caryophyllata*) from you, with the statement that they are used by the natives of the Seychelles in dyeing, and with the request that I would give you my opinion as to their merits.

Unfortunately the intervening summer holidays have prevented me from replying till now.

I separated the skin of this fruit from the kernel, after drying, and dyed with this part only, since this alone appears to posses any tinctorial power.

As a dye stuff it is of little value. It behaves really like a tannin matter, and I have therefore handed over the remainder of my sample to Mr. Proctor, asking him to examine it for tannic acid and to report to you.

For your inspection I enclose three pieces of mordanted cotton dyed with weld, gall nuts, and skin of the clove fruit, respectively, from which you see at a glance how it behaves.

It is attracted by mordants, giving grey with iron and buff-yellow with aluminium, very much after the manner of ground gall nuts.

Yours truly,
(Signed) J. J. HUMMEL.

CCCCXXX.—THE LAHAINA SUGAR-CANE.

The Lahaina cane of the Hawaiian Islands has been regarded as one of the most valuable varieties cultivated in that Archipelago. It has of late years been introduced to other sugar-producing countries, such as the Southern United States and the West Indies. It very closely resembles the white canes brought to Jamaica from the Pacific in His Majesty's ships by Captain Bligh in 1796. The Lahaina cane may very possibly, therefore, be the original of the canes now known in the West Indies, and other sugar countries, as the Cuban, Bourbon, or Otaheite. These are valuable white canes so closely resembling each other that it is almost impossible to distinguish them. The history of the Lahaina cane has lately been published by the *Planter's Monthly* of the Hawaiian Islands. We reproduce the following extract from the *Sugar-cane* for November 1894:—

Origin of the "Lahaina" Cane.

The following account of the "Lahaina cane" and its history has a certain possible value in view of the inquiries now being made in the endeavour to trace the facts connected with the origin and propagation of certain diseases of the cane.

In 1854 or 1855, Captain Edwards of the American whaleship "George Washington," brought a bundle of choice sugar-cane from Marquesas for Mr. Charles Titcomb, of Hanalei, Kauai. As the ship put into Lahaina first, and the facilities for sending the cane to Kauai were few and far between, he gave them to Consul Chase, who planted some in his garden. Mr. F. A. Oudinot, a resident of Lahaina, known as "Marshal Oudinot," also planted some of this cane on his premises. From these few plants sprang what is now known as Lahaina cane. It proved to be a remarkably rapid grower, very sweet, and as the leaves dropped off readily, an easy cane to handle and take care of, and in appearance very handsome and attractive.

The Lahaina cane has obtained the preference over the Cuban, its advantages being :—1. Rapid growth, thus quickly covering the ground and requiring less labour for cultivating and irrigating. 2. Deep rooting, drawing nourishment from the subsoil, or from soil the surface of which has already been exhausted by other varieties of cane. 3. Possessing, when mature, a hard rind which prevents the ravages of rats. 4. The superior richness of its juice, generally weighing one-third more than the juice of other varieties of cane cultivated under like circumstances. 5. It possesses a compact, firm fibre, which renders the trash easy to handle, and enhances its value as fuel. With these advantages may be mentioned the peculiar whiteness of its juice when mature, which exceeds that of any other island variety, and with its superior density would naturally insure white grades of sugar.

About the year 1870–72, the Lahaina cane began to take the place generally throughout these islands of other canes, increasing the average yield from two or three tons per acre to four, five, and even six tons, under similar conditions of cultivation and manufacture in various localities of the group.

This increase of yield from Lahaina cane has continued from year to year under more favourable mill work, until now it is not uncommon to hear planters report eight, nine, and ten tons of sugar obtained from favoured portions of the plantation. Where this cane is well cultivated and cared for, there appears to be no appreciable deterioration in any of its leading characteristics of easy cultivation, easy stripping and handling, the juice maintaining its high, excellent qualities as the purest, richest, and most productive of any variety known, at least so far as our soil and climate are concerned. It has been exclusively grown on some of our plantations for over 20 years, and remains as thrifty and productive as when first planted. At the same time it should be stated that it is very sensitive to cold, and thrives best on lowlands and in warm sheltered localities.

CCCCXXXI.—BOTANIC STATIONS IN THE LEEWARD ISLANDS.

Botanic stations were established in the Leeward Islands in 1889. Of the four stations, Antigua, Dominica, St. Kitts, and Montserrat, the most successful, so far, is undoubtedly that at Dominica. Particulars of this are given in the *Kew Bulletin*, 1893, pp. 148 and 359; 1894, p. 405.

In the Annual Report on the Leeward Islands for 1893, submitted by Sir William Haynes Smith to the Secretary of State for the Colonies

(Colonial Reports, Annual, No. 112, 1894), the following particulars are given respecting the work of the stations during that year:—

The work of the Antigua botanical station was carried on actively during the past year. Besides the ordinary sale of plants, a large rockery was added to the station and stocked with valuable succulents from Kew. A series of manurial plots were laid out with different kinds of vegetables, &c. The number of sisal plants in the nurseries was largely increased.

In St. Kitts the work was somewhat interfered with by the change of curator. The many plants put in the grounds are beginning to show. Very large plant sheds were erected and stocked with ornamental and economic plants, and the station, now in its second year, is rapidly assuming shape.

The botanical station in Dominica has proved its usefulness by the very great number of economic plants sold, over 22,000 having been sent out during the year, principally in small lots. This increased demand for plants has taxed the resources of the station to the utmost. An extra grant of 50*l.* has been made for the work of the current year.

The small botanic garden in Montserrat was slightly enlarged, and new walks and seats were added. The station was without a curator for a good part of the year, and not much progress can be reported.

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ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

APPENDIX I.—1894.

LIST OF SEEDS OF HARDY HERBACEOUS PLANTS AND OF TREES AND SHRUBS.

The following is a list of such Hardy Herbaceous Annual and Perennial Plants as well as of such Trees and Shrubs as have matured seeds under cultivation in the Royal Gardens, Kew, during the year 1893. These seeds are available for exchange with Colonial, Indian, and Foreign Botanic Gardens, as well as with regular correspondents of Kew. The seeds are only available in moderate quantity, and are not sold to the general public. It is desirable to add that no application, except from remote colonial possessions, can be received for seeds after the end of March.

HERBACEOUS PLANTS.

Acæna cylindrostachya, R. & P., Chili.
  macrostemon, Hk. fil., N. Zealand.
  microphylla, Hk. fil., N. Zealand.
  myriophylla, Ldl., Chili.
  ovalifolia, Ruiz et Pavon, Peru.
  Sanguisorbæ, Vahl, New Zeal.

Acanthus longifolius, Host., S. Eur.

Achillea Ageratum, L., Europe.
  aegyptiaca, L., Eur., etc.
  decolorans, Schrad., Eur.
  filipendulina, Lam., Caucasus.
  ligustica, All., Eur.

Achillea—*cont.*
  Millefolium, L., Eur.
  Ptarmica, L., Eur.
  rupestris, H. P. R., Tyrol.
  setacea, W. & K., Eur.

Aconitum heterophyllum, Wall, India.
  Lycoctonum, L., Eur., etc.
  — var. orientale, Hort.
  Napellus, L., Eur., Temp. Asia.
  — var. album.
  volubile, Pall., Siberia.

Acroglochin chenopodioides, Schrad., W. Himal.

Actæa spicata, L., N. Amer.

Actinolepis coronaria, Gray, Calif.

Actinomeris squarrosa, Nutt., N. Amer.

Adenophora liliifolia, Bess., Hungary, etc.

Adlumia cirrhosa, Raf., Unit. States.

Adonis æstivalis, L., Eur.

Ægilops triuncialis, L., S. Eur.

Ægopogon pusillus, Beauv., Mexico.

Æthionema Buxbaumii, DC., Thrace.
græcum, B.S., Greece.
pulchellum, Boiss., Armenia.
saxatile, R.Br., S. Eur.

Agrimonia odorata, Mill., Eur.

Agropyrum dasyanthum, Led., Siberia.
glaucum, R.S., Eur.

Agrostis alba, L., Eur.
— var. stolonifera, (L.)
interrupta, L., S. Eur.
vulgaris, With., Eur.

Ainsworthia cordata, Boiss., Asia Minor.

Alchemilla alpina, L., Eur.
argentea, Don., Eur.
vulgaris, L., Eur.

Alisma Plantago, L., Eur.

Allium angulosum, L., Siberia.
atropurpureum, W. et K., Hungary.
bauerianum, Baker, Orient.
carinatum, L., Eur.
Cydni, S. & K., Sicily.
fistulosum, L., Siberia.
flavum, L, Eur.
giganteum, Regel., Siber.
globosum, Redouté., S. E., Eur.
— var. albidum.
hymenorrhizum, Ledeb., Siberia.
— var. tenuifolium, Regl.
karatavieuse, Rgl., Turkestan.
narcissiflorum, Vill., Eur.
nigrum, L., Eur.
odorum, L., Siberia.
ostrowskianum, Rgl., Asia Minor.
polyphyllum, Kar. et Kir., Siberia.
pulchellum, Don., Eur.

Allium—*cont.*
roseum, L., Eur.
Schœnoprasum, L., Eur.
— var. sibiricum, (L.)
senescens, L., Eur., Siber.
stipitatum, Rgl., Turkestan.
subhirsutum, L., Eur.
urceolatum, Rgl., Turkestan.
ursinum, L., Eur.
Victorialis, L., Eur., Siber., etc.

Alopecurus agrestis, L., Eur.
geniculatus, L., Eur.
nigricans, Hornem., Eur.
pratensis, L., Eur.
— var. fol. variegatis.

Alstrœmeria aurantiaca, Don, Chili.
hæmantha, R. et P., Chili.

Althæa ficifolia, Cav., Dalm., etc.
Heldreichii, Boiss., Macedonia.
rosea, Cav., Eur., Orient.
sulphurea, Boiss. et H., Persia.

Alyssum argenteum, Vitm., Eur.
incanum, L., Eur.
montanum, L., Eur.
podolicum, Bess., Eur., etc.
saxatile, L., Russia.

Amaranthus chlorostachys, Willd., India.
hypochondriacus, L., Amer., etc.
— var. caudatus, (L.)
— var. speciosus, (Don.)
retroflexus, L., Amer., etc.

Amblyolepis (*see* Helenium).

Ambrosia trifida, L., N. Amer.

Amsinckia intermedia, F. and M., N. Amer.

Anacyclus radiatus, Loisl., Eur.

Anagallis arvensis, L., Eur., etc.
— var. carnea, (Schrank.)
— var. cœrulea, (Schreb.)

Anchusa italica, Retz., Eur.
officinalis, L., Eur.

Androsace filiformis, Retz., Eur.
lactiflora, Fisch., Siberia.
nana, Horn, Eur.

Andryala cheiranthifolia, Ait., Madeira.

Anemone albana, Stev., Orient.
  baldensis, L., Eur.
  coronaria, L., S. Eur., etc.
  decapetala, L., N. Amer.
  multifida, Poir., N. Amer.
  pratensis, Mill., Eur.
  Pulsatilla, L., Eur., etc.
  rivularis, Buchan., Himal.
  sylvestris, L., Eur.

Anethum graveolens, L., Eur.

Angelica dahurica, Benth. et Hook., Japan.

Anoda hastata, Cav., Mexico.
  Wrightii, Gray, Mexico.

Antennaria dioica, Gærtn., Eur., etc.
  — var. tomentosa.

Anthemis ætnensis, Schouw., Mt. Etna.
  Bourgœi, B. et R., Spain.
  Kitaibellii, Spr., Hungary.
  nobilis, L., Eur.
  — var. discoidalis.
  peregrina, Willd., S. Eur.

Anthericum Hookeri, Colenso, N. Zealand.
  Liliago, L., S. Eur., N. Afr.
  — var. algeriense, B. & R.
  ramosum, L., Eur.

Anthoxanthum odoratum, L., Eur.
  Puelii, Lecoq. et Lamotte, Eur.

Anthriscus Cerefolium, Hoffm., Eur.
  sylvestris, Hoffm., Eur.
  vulgaris, Pers., Eur.

Anthyllis Vulneraria, L., Eur.

Antirrhinum Asarina, L., Italy.
  majus, L., Eur.
  meonanthum, Hffgg., Spain, etc.
  Orontium, L., Eur.
  rupestre, Boiss. et Reut., Spain.

Aquilegia Bertolonii, Schott., Ital.
  chrysantha, Gray, N. Amer.
  flavescens, S. Wats., Californ.
  vulgaris, L., Eur.

Arabis albida, Stev., Caucas.
  — var.
  alpestris, Schl., Eur.

Arabis—*cont.*
  alpina, L., Eur., N. Afr.
  cebennensis, DC., Eur.
  petræa, Crantz., Eur.
  pumila, Jacq., S. Eur.
  Soyeri, B, et R., Pyrenees.
  stricta, Huds., Eur.
  Turczaninowii, Led., Siberia.

Archangelica officinalis, Hoffm., Eur.

Arctium majus, Schk., Eur.
  — var. Kotschyi, Hort.

Arenaria fasciculata, Gouan, Eur.
  gothica, Fr., Eur.
  graminifolia, Schrad., S. Eur.
  — var. multiflora.
  — var. parviflora.
  gypsophiloides, Schreb., Orient.
  hirta, Wormsk., Eur.
  laricifolia, L., Eur.
  purpurascens, Ram., Pyren.

Argemone hispida, Hook., Calif.
  mexicana, L., Mexico.
  — var. alba.

Armeria maritima, Willd., Eur.
  — var. alba.
  vulgaris, Willd., Eur.
  Welwitschii, Boiss., Spain.

Arnica amplexicaulis, Nutt, N. Amer.
  montana, L., Eur.

Arrhenatherum avenaceum, Beauv., Eur.

Artemisia annua, L., S. E. Eur.

Arthraxon Langsdorfii, Trin., China, etc.

Arum italicum, Mill., Eur.
  maculatum, L., Eur.

Asparagus officinalis, L., Eur.

Asperula azurea, Jaub. et Spach., Syria.
  galioides, Bbrst., Eur.
  tinctoria, L., Eur.

Asphodelus albus, Willd., Eur.
  ramosus, L., S. Eur.

Asprella hystrix, Willd., N. Amer.

Aster alpinus, L., Eur.
  corymbosus, Ait., N. Amer.
  Curtisii, Gray, N. Amer.
  puniceus, L., N. Amer.

Aster—*cont.*
— var. lucidulus, Gray.
(A. vimineus, T. et Gr.)
pyrenæus, DC., Pyren.
Radula, Ait., N. Amer.
sibiricus, L., Siber.
tricephalus, C. B. Clarke, Himal.

Astragalus ægyptiacus, Spr., Egypt.
alpinus, L., N. Amer.
boeticus, L., Spain, Italy, etc.
chinensis, L., China.
chlorostachys, Ldl., Himal.
Cicer, L., Eur.
dasyglottis, Fisch., Siber.
frigidus, Gray, N. Amer.
glycyphyllus, L., Eur.
hypoglottis, L., Eur.
— var. albus.
scorpioides, Pourr., Spain.
sulcatus, L., Siber., Taur.

Astrantia Biebersteinii, F. et M., Caucas.
helleborifolia, Salisb. Caucas.
major, L., Eur., etc.
— var. carinthiaca, (Hoppe.)

Athamanta cretensis, L., Eur.
sicula, L., Eur.

Atriplex Babingtonii, Woods, Eur.
hortensis, L., N. Asia.
— var. rubra, Hort.
sibirica, L., Siberia.

Atropa Belladonna, L., Eur.

Aubrietia deltoidea, DC., S. Eur.
— var. græca, (Griseb.)
— var. grandiflora.
— var. Leichtlinii, Hort.
— var. Richardi, Hort.
erubescens, Griseb., Greece.
gracilis, Sprun., Eur.

Avena brevis, Rth., Eur.
distichophylla, Vill., Eur.
fatua, L., Eur.
— var. intermedia, Lindgr.
pratensis, L., Eur. Siber.
pubescens, Huds., Eur.
strigosa Schreb., Eur.

Baeria chrysostoma, F. et M., Calif.
gracilis, Gray, W. Calif.

Bahia lanata, DC., N. Amer.

Baptisia australis, R. Br., N. Amer.

Barbarea intermedia, Bor., Eur.
praecox, Br., Eur.
vulgaris, R. Br., Eur.
— var. variegata.

Beckmannia erucæformis, Host, Eur., etc.

Beta trigyna, W. et K., E. Eur.
vulgaris, L., Eur., Afr., etc.

Bidens humilis, H. B. K., Chili.
leucantha, Willd., N. Amer., etc.

Biscutella ciliata, DC., S. Eur.
didyma, L., S. Eur.
erigerifolia, DC., Spain.

Blitum (*see* Chenopodium).

Blumenbachia insignis, Schrad., Monte Video.

Bocconia cordata, W., China.

Boissiera Danthoniae, A. Br., S. Eur.

Bonaveria Securidaca, Rch., Eur.

Boykinia major, Gray, N. Amer.

Brachycome iberidifolia, Benth., Australia.

Brachypodium distachyum, R. et S., Medit.

Brassica balearica, P., Eur.
campestris, L., Eur., etc.
— var. Shantung Cabbage.
(B. chinensis, L.)
Eruca, L., S. Eur.
Erucastrum, Vill., S. Eur.
juncea, Hk. f. et Th., N. Ind.
nigra, Koch, Eur.
oleracea, L., Eur.
Pollichii, Shuttl.
rugosa, Roxb., Thibet.
Tournefortii, Gouan, Spain, etc.

Briza maxima, L., Eur.
media, L., Eur.
minor, L., Eur.

Brodiæa congesta, Sm., N. Amer.
peduncularis, Wats., Calif.
uniflora, Bth., Buenos Ayres.

Bromus adœnsis, Hochst.
  Biebersteinii, R. et S., Caucas.
  breviaristatus, Thurb., N. Amer.
  ciliatus, Huds., Eur.
  erectus, Huds., Eur., etc.
  madritensis, L., Eur.
  maximus, Desf., Eur.
  mollis, L., Eur., etc.
  propendens, Jord., Eur.
  racemosus, L., Eur.
  Taena, Steud., Chili.
  tectorum, L., Eur., Asia.

Browallia viscosa, H.B.K., Peru.

Bryonia dioica, L., Eur.

Bulbine annua, Willd., Cape.

Bunias orientalis, L., Orient.

Buphthalmum speciosum, Schreb., Eur.

Bupleurum Candollei, Wall., Himal.
  rotundifolium, L., Eur.

Butomus umbellatus, L., Eur.

Calais (*see* Microseris).

Calamintha Clinopodium, Bth., Eur.
  grandiflora, Lam., S. Eur.
  officinalis, Mich., var. umbrosa, Rchb., Eur.

Calandrinia glauca, Schrad., Chili.
  pilosiuscula, DC., Chili.
  umbellata, DC., Chili.

Calceolaria mexicana, Benth., Mexico.

Calendula arvensis, L., S. Eur.
  hybrida, L., S. Eur.
  officinalis, L., S. Eur.

Calliopsis (*see* Coreopsis).

Callirhöe involucrata, Gray, N. Amer.
  pedata, Gray, N. Amer.

Callistephus chinensis, Nees., China.

Caltha palustris, L., Eur., etc.
  — var. minor, Syme.
  radicans, Forster, Eur., etc.

Camassia esculenta, Ldl., N. Amer.

Camelina sativa, Crantz, Eur., etc.

Campanula alliariæfolia, Willd., Caucas.
  carpathica, L. fil., Carpath.
  — var. alba.
  — var. turbinata, (Schott.)
  collina, Bbrst., Caucas.
  Erinus, L., Eur.
  excisa, Schl., Switzerland.
  glomerata, L., Eur., etc.
  lactiflora, Bbrst., Caucas.
  — var. cœrulea.
  latifolia, L., Eur., etc.
  — var. macrantha, (Fisch.)
  — var. versicolor, (Sib. et Sm.)
  latiloba, DC., Olympus.
  persicifolia, L., Eur., etc.
  — var. alba.
  — var. maxima.
  primulæfolia, Brot., Portugal.
  ramosissima, S. & S., Dalm.
  rapunculoides, L., Eur.
  rhomboidalis, L., Eur.
  Scheuchzeri, Vill., Eur.
  sibirica, L., Eur., Asia.
  subpyrenaica, Timb., Eur.
  Trachelium, L., Eur.

Cannabis sativa, L.

Cardamine græca, L., Greece.
  impatiens, L., Eur.

Carduus acanthoides, L., Eur.
  nutans, L., Eur.
  orthocephalus, Wallr. ×
  stenolepis, (K. et K.), Siber.

Carex adusta, Boot., N. Amer.
  Buxbaumii, Whlnb., Eur.
  depauperata, Good., Eur.
  flava, L., Eur., etc.
  Heleonastes, Ehrh., Eur.
  hordeiformis, Whlbrg., Eur. Cauc.
  lagopodioides, Schk., N. Amer.
  leporina, L., Eur.
  paniculata, L., Eur.
  sylvatica, Huds., Eur.
  vulpina, L., Eur.

Carpoceras sibiricum, Boiss., Siber.

Carrichtera Vella, DC., Eur.

Carthamus lanatus, L., S, Eur.
  tinctorius, L. Eur.

Carum Carvi, L., Eur.
  rigidulum, Koch., Italy.

Catananche cœrulea, L., Eur.
lutea, L., Italy, etc.

Cathcartia villosa, Hk. f., Himal.

Caucalis daucoides, L., Eur.

Centaurea alba, L., var. deusta, Ten., S. Eur.
Cyanus, L., Eur.
cynaroides (Less.), Pyrenees.
dealbata, Willd., Caucas.
glastifolia, Led., Eur. Asia.
gymnocarpa, Mor., Eur.
melitensis, L., Eur.
nigrescens, Willd., Eur.
nigra, L., Eur.
Scabiosa, L., Eur.
— var. alba.
— var. olivieriana, (DC.)

Cephalaria alpina, Schrad., Eur.
tatarica, Schrad., Siberia.

Cerastium chloræfolium, F. et M. Orient.
frigidum, Bbrst., Caucas.
ovatum, Hoppe, Eur.
tomentosum, L., var lanigerum, Clem., Eur.

Ceratochloa unioloides, DC., S. Eur.

Cerinthe alpina, Kit., Eur.
aspera, Bth., Eur.
maculata, Bbrst., var. auriculata, Ten., Eur.

Charieis heterophylla, Cass, Cape.
— var. rubra.

Cheiranthus Cheiri, L., Eur.

Chelidonium majus, L., Eur.
— var. fl. pl.
— var. laciniatum.

Chelone Lyoni, Pursh, N. Amer.

Chenopodium album, L., Eur.
aromaticum, Hort., Berlin.
Atriplicis, L., China.
Bonus-Henricus, L., Eur.
Botrys, L., Eur.
capitatum, Wats., Eur.
fœtidum, Schrad., Eur.
graveolens, Willd., Mexico.
opulifolium, Schrad., Eur.
virgatum, Benth. et Hook., S. Eur.

Chorispora tenella, DC., Cauc., etc.

Chlorogalum pomeridianum, Ldl., Calif.

Chrysanthemum carinatum, Schousb., N. Afr.
— var. atrococcineum.
cinerariæfolium, Vis., Dalmatia.
coronarium, L., S. Eur.
— var. album.
— var. fl. pl.
corymbosum, L., Eur.
latifolium, Willd., Eur.
maximum, DC., Pyrenees.
macrophyllum, W. et K., Eur.
multicaule, Desf., N. Afr.
Parthenium, Pers., Eur.
segetum, L., Eur.
setabense, Duf., Eur.
Tchihatcheffii (Pyrethrum, Regel), Siber.
viscosum, Desf., Spain.

Cicer arietinum, L., Eur.

Cichorium Intybus, L., Eur.

Cimicifuga fœtida, L., Eur.
— var. intermedia.
racemosa, Nutt., N. Amer.

Circaea lutetiana, L., Eur., etc.

Clarkia elegans, Lindl., Calif.
pulchella, Pursh., N. Amer.
— var. alba.

Claytonia perfoliata, Don., N. Amer.
sibirica, L., N. Amer.

Clematis integrifolia, L., S. Eur.
ochroleuca, Ait., N. Amer.
recta, L., Eur., etc.

Cleome speciosa, H. B., Carthagenia.
violacea, L., Eur.

Cnicus altissimus, Willd., N. Amer.
arachnoideus, Wall., Himal.
canus, Willd., Eur.
ciliatus, Willd., Eur.
fimbriatus, Bieb., Taurus.
horridus, Bbrst., Cauc.
intermedius, Heller., Eur.
lanceolatus, Willd., Eur.
monspessulanus, L., Eur.
syriacus, Willd., Medit.

Cochlearia glastifolia, L., S. Eur.
officinalis, L., Eur.

Codonopsis ovata, Benth., Himal.

Colchicum speciosum, Stev., Caucas.

Collinsia bartsiæfolia, Benth., Calif.
bicolor, Benth., Calif.
— var. multicolor.
grandiflora, Dougl., N. Amer.
parviflora, Dougl., N. Amer.

Collomia coccinea, Lehm., Chili.
gilioides Benth., Calif.
grandiflora, Dougl., Calif.
linearis, Nutt., Calif.

Conringia perfoliata, Link, Eur.

Convallaria majalis, L., Eur., Amer.
— var. major.
— var. rosea.

Convolvulus tricolor, L., Medit.
— var. alba.
— var. monstrosa.
undulatus, Cav., Medit.

Coreopsis auriculata, L., N. Amer.
coronata, Hook., E. Texas.
Douglasii, B. et H., Calif.
Drummondi, T. & G., Texas.
grandiflora, Nutt., N. Amer.
maritima, Hook., Calif.
lanceolata, L., N. Amer.
— var. villosa, Michx.
tinctoria, Nutt., N. Amer.
— var. atrosanguinea.
— var. bicolor.

Coriandrum sativum, L., Eur., etc.

Corispermum hyssopifolium, L., S. Eur.

Cortusa Matthioli, L., Eur.
— var. grandiflora.

Corydalis glauca, Pursh., United States.

Cosmos bipinnatus, Cav., Mexico.

Cotula coronopifolia, L., Eur.
filicula, Hk. fil., Australia.

Crambe pinnatifida, R. & S., Turkest.

Crepis Candollei, Spr., Eur.
grandiflora, Tausch., Eur.
hyoseridifolia, Tausch., Eur.
pulchra, L., Eur.
rubra, L., S. Eur.
setosa, Hall. f., Eur.
tectorum, L. fil., Eur., Siberia.

Crocus bannaticus, Heuffel, Transylvania.
etruscus, Parl., Tuscany.
gargaricus, Herb., W. Bithynia.
Imperati, Ten., Italy.
medius, Balbis, Riviera.
nudiflorus, Sm., Eur.
pulchellus, Herb., Greece.
reticulatus, Bbrst., Caucas.
sativus, L., Cult.
— var. cartwrightianus, Herb.
Sieberi, Gay, Greece, etc.
speciosus, Bbrst., Caucas., etc.
suaveolens, Bert., C. Italy.
tommasinianus, Herb., Dalmat.
vernus, All., C. Eur.
versicolor, Ker., Eur.
zonatus, Gay, Cilicia.

Crucianella ægyptiaca, L., Egypt.

Cryptostemma calendulaceum, R.Br., Cape.

Cuminum Cyminum, L. Egypt.

Cuphea lanceolata, Ait., Mexico.
viscosissima, Jacq., Amer.
Zimapani, Roezl, Mexico.

Cynodon Dactylon, Pers., Eur.

Cynoglossum officinale, L., Eur.
pictum, Ait., Eur.

Cynosurus cristatus, L., Eur.
elegans, Desf., S. Eur.

Cysticapnos africanus, Gærtn., Cape.

Czackia Liliastrum, Andrz., S. Eur.

Dactylis glomerata, L., Eur., etc.

Dahlia coccinea, Cav., Mexico.
scapigera, L. & O., Mexico.
variabilis, Desf., Mexico.

Datura lævis, L. fil., Africa.
Stramonium, L., Eur.
Tatula, L., Eur., etc.
— var. gigantea.

Daucus Carota, L., Eur., etc.
hispidus, Desf., Eur., N. Afr.

- Delphinium Ajacis, Reichb., S. Eur.
  - — var. fl. pl.
  - brunonianum, Royle, Himal.
  - cardiopetalum, DC., Eur.
  - caucasicum, L., Caucas.
  - Consolida, L., Eur.
  - crassifolium, Schrad., Cauc.
  - dictyocarpum, DC., Siberia.
  - elatum, L., Eur., etc.
  - — var. intermedium.
  - formosum, Hort.
  - grandiflorum, L., China, etc.
  - Maackianum,. Regel., Asia Minor.
  - orientale, Gay, Eur., Orient.
  - Staphisagria, L., Eur.
  - triste, Fisch., Siberia.
  - trolliifolium, Gray, Amer.
  - vestitum, Wall., Himal.

- Deschampsia cæspitosa, Beauv., Eur.
  - flexuosa, Trin., Eur.

- Desmazeria sicula, Dmrt., Eur.

- Dianthus arenarius, L., Eur.
  - atrorubens, All., Eur.
  - callizonus, Sch. & Ky., Transyl.
  - Caryophyllus, L., Eur.
  - cæsius, Sm., Eur.
  - — var.
  - deltoideus, L., Eur.
  - fimbriatus, Bbrst., Orient.
  - fragrans, Bbrst., Caucas.
  - giganteus, D.'Urv., E. Eur.
  - intermedius, Boiss., var. ambiguus, Panc., Servia.
  - liburnicus, Bartl., Eur.
  - longicaulis, Ten., Italy.
  - monspessulanus, L., Eur.
  - Mussinii, Hornm., Caucas.
  - pelviformis, Heuffl., Transyl.
  - petræus, W. & K., E. Eur.
  - plumarius, L., Eur.
  - — var. serotinus.
  - prolifer, L., Eur.
  - pulchellus, Pers., Eur.
  - Requienii, G. et G., S. Eur.
  - tener, Balb., Eur.

- Dictamnus albus, L., W. Eur., Jap.

- Digitalis lutea, L., Eur.
  - purpurea, L., Eur.
  - — var. alba, Hort.

- Dimorphotheca annua, Less., Cape.

- Dioscorea pyrenaica, Bub. et Bord., Pyren.

- Diplotaxis erucoides, DC., Mediter.
  - tenuifolia, DC., Eur.

- Dipsacus asper, Wall., Himal.
  - atratus, Hkf. & Th., Himal.
  - Fullonum, L.
  - laciniatus, L., Eur.
  - sylvestris, L., Eur.

- Dodecatheon Meadia, L., N. Amer.
  - — var. macrocarpum, Gray.

- Dorycnium herbaceum, Vill., Eur.

- Draba aizoides, L., Eur.
  - arabisans, Michx., N. Amer.
  - borealis, DC., Isl. of St. Paul.
  - frigida, Saut., Alps, Eur.
  - incana, L., Eur.
  - — var. stylaris, (Gay.)
  - Kotschyi, Stur., Transyl.
  - lasiocarpa, Reichb., S. Eur.
  - Loiseleurii, Boiss., Corsica.
  - longirostra, S.N.K., Transyl.
  - stellata, Jacq., Transyl.

- Dracocephalum Moldavica, L., Siber., etc.
  - nutans, L., Siberia.
  - parviflorum, Nutt., N. Amer.
  - peregrinum, L., Siberia.

- Dryas octopetala, L., Eur., Amer.

- Echinops globifer, Janka, Transyl.
  - bannaticus, Roch., Eur.
  - sphærocephalus, L., Eur.

- Elsholtzia cristata, Willd., S. Eur.

- Elymus canadensis, L., N. Amer.
  - — var. glaucifolius, Gray.
  - sibiricus, L., Siber.
  - virginicus, L., N. Amer.

- Emex spinosa, Camb., S. Eur.

- Encelia subaristata, Gray, N. Amer.

- Epilobium alpestre, Jacq., Eur.
  - alsinefolium, Vill., Eur.
  - angustifolium, L., Eur.
  - — var. album.
  - Fleischeri, Hochst., Eur.
  - hirsutum, L., Eur.
  - Lamyi, Schultz, S. Eur.
  - linnæoides, Hook. fil., N. Zeal.
  - mexicanum, Moc., Mexico.
  - nummulariæfolium, A. Cunn., N. Zeal.

Epilobium—*cont.*
— var. longipes.
— var. pedunculare, Cunn.
roseum, Retz., Eur.
rosmarinifolium, Hænke, Eur.
— var. sericeum.

Eranthis hyemalis, Salisb., Eur.

Eremurus altaicus, Stev., Altai.
Kaufmanni, Regel., Turkestan.

Erigeron aurantiacus, Regel., Turkestan.
bellidifolius, Muhl., N. Amer.
glabellus, Nutt., N. Amer.
— var. asperus, Gray.
pulchellus, Regel., Turkestan.
strigosus, Muhl., N. Amer.

Erinus alpinus, L., Eur.
— var. albus.

Eritrichium strictum, Dcne., Himal.

Erodium gruinum, Willd., Sicily.
macradenium, L'Herit., Alps.
malacoides, Willd., Eur.
moschatum, L'Her., Eur.
Salzmanni, Del., Eur.
serotinum, Stev., Orient.

Ervum Lens, L., Eur., etc.

Eryngium giganteum, Bbrst., Caucas.
macrocalyx, Schr., Songaria.
oliverianum, Delar. Orient.

Erysimum aureum, Bbrst., Eur., Orient.
marshallianum, Andrz., Siber.
perowskianum, Fisch. et Mey., Caucus.
Wahlenbergii, Simonk, Transs.

Erythræa Centaurium, P., Eur.

Eschscholtzia californica, Cham., Calif.
— var. alba.
— cæspitosa, Brewer.

Eucharidium concinnum, F. et M., Calif.
— var. grandiflorum.

Eupatorium ageratoides, L., N. Amer.
cannabinum, L., Eur.

Euphorbia exigua, L., Eur.
flavicoma, DC., Eur.
hierosolymitana, Boiss., Syria.
Myrsinites, L., Eur.
Preslii, Guss., Eur.

Farsetia clypeata, Br., S. Eur.

Fedia Cornucopiæ, G., Eur.

Ferula communis, L., Eur.
glauca, L., S. Eur.
— var. candelabra, Heldr.
Linkii, Web., Canaries.

Festuca capillifolia, Duf., Spain.
delicatula, Lag., Eur.
duriuscula, L., Eur., Amer.
— sub-var. crassifolia.
elatior, L., Eur., etc.
— var. pratensis, (Huds.)
gigantea, Vill., Eur.
Halleri, All., S. Eur.
heterophylla, Lam., Eur.
Myurus, L., Eur.
Panciciana, Hack., Orient.
rigida, Kunth, Eur.
sciuroides, Roth, Eur.
scoparia, Kern., Pyren.

Fritillaria armena, Boiss., Asia Minor.
delphinensis, Gren., Eur.
— var. Moggridgei, (Boiss. et Reut.).
Meleagris, L., Eur.
— var. alba.
ruthenica, Wikstr., Orient.

Fumaria amarysia, B. et. H., Eur.
densiflora, DC., Eur.
— var. (micrantha, Lag.)
major, Bad., Eur.

Funkia lancifolia, Spr., Japan.
— var. albo-marginata, Hort.
ovata, Spr., Japan.
siebòldiana, Lodd., Japan.

Gaillardia pulchella, Foug., N Amer.
— var. grandiflora.

Galega officinalis, L., Eur.
orientalis, Lam., Orient.

Galeopsis pyrenaica, Bartl., Pyren.

Galinsoga brachystephana, Regel., S. Amer.
parviflora, Cav., Amer.

Galium boreale, L., Eur.
parisiense, L., Eur.
recurvum, Reg., Greece.
saccharatum, All., Eur.
tenuissimum, Bbrst., Cauc.
tricorne, With., Eur.
uliginosum, L., Eur.
verum, L., Eur.

Gaudinia fragilis, P.B., S. Eur.

Gaura parviflora, Dougl., N. Amer.

Gentiana acaulis, L., Eur.
asclepiadea, L., S. Eur.
— var. alba.
cruciata, L., Eur. Siber.
lutea, L., Eur.
Pneumonanthe, L., Eur.
septemfida, Pall., Caucas.
tibetica, King, Himal.

Geranium albanum, M. B., Tauria.
armenum, Boiss., Orient.
columbinum, L., Eur.
eriostemon, Fisch., Caucas.
gymnocaulon, DC., Caucas.
Londesii, Fisch., Siber.
lucidum, L., Eur.
maculatum, L., N. Amer.
molle, L., Eur.
nodosum, L., Eur.
pratense, L., Eur.
— var. alba.
pyrenaicum, L., Eur.
rivulare, Vill., Eur.
rotundifolium, L., Eur.
sylvaticum, L., Eur.
Vlassovianum, Fisch., Siber.
wallichianum, Sw., Himal.

Gerbera Anandria, Schultz., China, Japan.

Geum chilœnse, Balb., Chili.
— var. grandiflorum, Ldl.
— var. miniatum, Hort.
hispidum, Fr., Spain.
macrophyllum, Willd., Siber.
montanum, L., Alps, Eur.
rivale, L., Eur.
triflorum, Pursh., N. Amer.
urbanum, L., Eur., etc.

Gilia achilleæfolia, Bth., Calif.
androsacea, Steud., Calif.
— var. rosea.
capitata, Dougl., Calif.
inconspicua, Dougl., Calif.
laciniata, R. et P., Chili, Peru.
micrantha, Steud., Calif.

Gilia—*cont.*
squarrosa, Hook. et Arn., Amer.
tricolor, Benth., Calif.
— var. alba.

Gladiolus segetum, Gawl., S. Eur.

Glaucium corniculatum, Curt., S. Eur.
— var. rubrum, Hort.
flavum, Crantz., var. fulvum, Sm.

Glyceria maritima, Wahl., Eur.
remota, Fr., Eur.

Gnaphalium indicum, L., India.

Gunnera scabra, R. et P., Peru, etc.

Gypsophila paniculata, L., Siberia.
Rokejeka, Del., Egypt.

Hablitzia tamnoides, Bbrst., Caucas.

Hastingia alba, S. Wats., N. Amer.

Hebenstreitia dentata, Thunb., Cape.
tenuifolia, Schrad, Cape.

Hedysarum boreale, Nutt., N. Amer.
microcalyx, Baker., Himal.
neglectum, Ledeb., Altai.
obscurum, L., Eur.

Helenium autumnale, L., N. Amer.
Bolanderi, Gray, N. Amer.
setigerum, B. et H., California.

Helianthemum polifolium, Mill., Eur.
vulgare, Gærtn., Eur.

Helianthus annuus, L., N. Amer.

Helichrysum bracteatum, Willd., Austral.
— var. album.
— var. luteum.

Heliophila amplexicaulis, L. fil., Cape.
araboides, Sims, Cape.
crithmifolia, Willd., Cape.

Helipterum Manglesii, Bth., Austral.
Milleri, Hort., Australia.
roseum, Benth., Australia.

Helleborus colchicus, Regel., Hort. ×.
foetidus, L., Eur.
orientalis, Lam., Greece.
— var. roseus.

Helminthia echioides, G., Eur.

Helonias bullata, L., N. Amer.
— var. latifolia.

Hemerocallis flava, L., S. Eur.
fulva, L., S. Eur., etc.
— var. Kwanso, Regel.

Heracleum Panaces, L., S. Eur.
pubescens, Bbrst., var. gummiferum, Willd., Eur.
villosum, Fisch., Russia.

Hesperis matronalis, L., Eur., Siber.

Heuchera Drummondi, Hort.
glabra, Willd., N. Amer.
pilosissima, F. et M., N. Amer.
sanguinea, Eng., N. Amer.

Hibiscus Trionum, L., Cosmopol.

Hieracium alpinum, L. Eur.
aurantiacum, L., Eur.
integrifolium, Lge., Eur.
Jankæ, Uechtr., E., Eur.
longifolium, Schleich., Eur.
maculatum, Sm., Eur.
nigrescens, W., Eur.
onosmoides, Fr., Eur.
pallidum, Biv., Eur.
pratense, Tausch., Eur.
saxatile, Jacq., S. Eur.
stoloniflorum, W. et K., S. Eur.
villosum, L., Eur.
virgatum, Pursh., N. Amer.
vulgatum, Fr., Eur.

Holcus lanatus, L., Eur.

Hordeum murinum, L., Eur.
pratense, Huds., Eur.
vulgare, L., Sicily.

Horminum pyrenaicum, L., Pyren.

Hyacinthus amethystinus, L., Spain.
romanus, L., S. Eur., etc.

Hydrophyllum canadense, L., N. Amer.
virginicum, L., N. Amer.

Hymenophysa pubescens, Meyer., Siber.

Hyoscyamus niger, L., Eur.
— var. albus, Hort.
orientalis, Bbrst., Cauc.

Hypecoum procumbens, L., S. Eur.

Hypericum Richeri, Vill., Eur.
— var. Burseri, Sp., Transs.

Hypochæris arachnoidea, Poir., N. Afr.

Iberis amara, L., Eur.
ciliata, All., Alp. Marit.
garrexiana, All., Pyrenees.
lagascana, DC., Spain.
pectinata, Boiss., Spain.
umbellata, L., S. Eur.
— var. carnea.

Impatiens parviflora, DC., Siberia, etc.
Roylei, Walp., Himal.
tricornis, Wall., Himal.

Inula ensifolia, L., Eur.
grandiflora, Willd., Caucas., etc.
Helenium, L., Eur.

Iris aurea, Ldl., Himal.
fulva, Muhl., N. Amer.
Pseudacorus, L., Eur., etc.
setosa, Pallas, Siberia.
— var. atropurpurea.
sibirica, L., Eur., Siberia.
spuria, L., Eur.
— var. notha, Bbrst.
versicolor, L., N. Amer.

Isatis tinctoria, L., Eur., etc.

Juncus balticus, Willd., Eur.
compressus, Jacq., Eur.
effusus, L., Eur.
lamprocarpus, Ehrh., Eur.
platycaulis, H.B.K., S. Amer.

Kochia scoparia, Schrad., Eur.

Kœleria Berythea, B. et B., Syria.
cristata, Pers., Eur.
phleoides, P., Eur.

Lactuca canadensis, L., N. Amer.
flavida, Jord., S. Eur.
hirsuta, L. N. Amer.
ludoviciana, Riddel, N. Amer.
Plumieri, Gren. et Godr., S. Eur.
Scariola, L., Eur.
undulata, Ledeb., Siberia.
Lallemantia peltata, Fisch. et Mey., Caucas.
Lasthenia glaberrima, DC., Amer.
obtusifolia, Cass., Chili.
Lathyrus angulatus, L., S. Eur.
Aphaca, L., Eur.
aureus, Benth. et Hook., Taur.
Clymenum, L., S. Eur.
filiformis, Lam., S. Eur.
hirsutus, L., Eur.
latifolius, L., Eur.
— var. ensifolius, Bad.
luteus, B. et Hk. f., Eur., etc.
macrorrhizus, Wimm., Eur.
niger, Wimm., Eur.
Ochrus, L., Eur.
pannonicus, Gcke., var. varius, Sol., Eur.
pisiformis, L., Siberia, etc.
rotundifolius, Willd., Caucas.
sativus, L. var. albus.
sphæricus, Retz., Eur.
sylvestris, L., Eur.
— var. Wagneri.
tingitanus, L., N. Afr.
— var. atropurpureus.
tuberosus, L., Eur.
venosus, Muhl., N. Amer.
— var.
Lavatera thuringiaca, L., Eur., etc.
trimestris, L., Medit.
— var. alba.
Layia Calliglossa, Gray., Calif.
elegans, T. et G., Calif.
glandulosa, Hk. et Arn., Calif., etc.
Leontodon Ehrenbergii.
Mülleri, (Sz.), Eur.
Leontopodium alpinum, Cass., Eur.
Lepidium calycotrichum, Kze., Eur.
Draba, L., Eur.
incisum, Roth, Eur.
Menziesii, DC., N. Amer.
sativum, L., Eur.
virginicum, L., N. Amer.

Leptochloa fascicularis, Gr., N. Amer.

Lepturus cylindricus, Trin., Eur.

Leuzea conifera, DC., Eur.

Libanotis montana, Crantz, Eur.
sibirica, Koch., Eur., etc.

Ligusticum pyrenæum, Gouan., Pyrenees.
scoticum, L., Eur.
Seguieri, Koch., S. Eur.

Limnanthes Douglasii, R. Br., Amer.
— var. grandiflora.

Linaria anticaria, Boiss., Spain.
bipartita, Willd., N. Afr.
Broussonetii, Poir., Orient.
chalepensis, Mill., Eur.
dalmatica, Mill., Dalm.
genistæfolia, Mill., Eur.
— var. linifolia, Grab.
minor, Desf., Eur., N. Afr.
minutiflora, Mey., Caucas.
Perezii, Gay, Eur.
prætermissa, Delas., France.
purpurea, L., Eur., etc.
reticulata, Desf., N. Afr.
— var. purpurea.
saxatilis, Hffgg., Eur.
spartea, Hoffm., S. Eur.
triphylla, Willd., S. Eur.
tristis, Mill., S. Eur.
vulgaris, Mill., Eur.

Lindelophia spectabilis, Lehm., Himal.

Linum alpinum, L., Eur.
angustifolium, L., Eur.
grandiflorum, Desf., N. Afr.
— var. coccineum.
maritimum, L., Eur.
perenne, L., Eur., etc.
— Lewisii, (Mhlbrg.)
usitatissimum, L., Eur.

Lithospermum latifolium, Michx., N. Amer.

Loasa lateritia Gill. et Hook., Chili.
volcanica, Andr., New Gren.

Lobelia cliffortiana, L., N. Amer.
Erinus, L., Cape.

Lolium perenne, L., Eur.
— var. italicum, (Braun.)

Lonas inodora, Gærtn., Sicily.

Lopezia coronata, Andr., Mexico.

Lophanthus rugosus, F. et M., China.

Lotus corniculatus, L., Eur.
major, Scop., Eur.
ornithopodioides, L., Eur.
tenuis, W. et K., Eur., etc.

Lunaria annua, L., Eur.
rediviva, L., S. Eur.

Lupinus angustifolius, L., S. Eur.
— var. macrocarpus, Hort.
Cosentini, Guss., Greece, etc.
densiflorus, Benth, Calif.
elegans, H. B. K., Mexico.
hilariensis, Benth., Brazil.
luteus, L., Europe.
Menziesii, Agardh., Calif.
micranthus, Dougl., N. Amer.
polyphyllus, Ldl., N. Amer.
pubescens, Benth., N. Amer.
pulchellus, Sweet., Mexico.
recurvatus, Meyer., Chili.
tricolor, Hort.
varius, L., Eur.

Luzula angustifolia, Poir., Carolina
campestris, DC., Eur.
nivea, Desv., Eur.

Lychnis alba, Mill., Eur.
chalcedonica, L., E. Eur., etc.
coronaria, Lam., Eur.
diurna, Sibth., Eur.
Flos-jovis, Desv., S. Eur.
Githago, Lam., Eur.
Lagascæ, Nym., Eur.
læta, Ait., S. Eur., etc.
oculata, Ldl., Levant.
— var. elegans.
pauciflora, Ledeb., Siber.
Viscaria, L., Eur.
— var. alba.

Lysimachia acroadenia, Max., Japan.
barystachya, Bunge, Japan.
ciliata, L., N. Amer.
davurica, Willd., Davuria.
Leschenaultii, Dub., Himal.
punctata, L., Eur.

Lysimachia—*cont.*
quadrifolia, L., N. Amer.
vulgaris, L., Eur.

Madia elegans, Don., N. Amer.
sativa, Molin., Oregon, Calif.
— var. racemosa, Gray.

Malcolmia africana, R.Br., S. Eur., N. Afr.
chia, DC., Greece.
littorea, R.Br., S. Eur.
maritima, R.Br., S. Eur., etc.

Malope trifida, Cav., N. Afr.
— var. alba.

Malva Alcea, L., Eur.
crispa, L., Orient.
Duriæi, Spach., N. Afr.
moschata, L., Eur.
— var. alba.
oxyloba, Boiss., Orient.
parviflora, L., Eur.
sylvestris, L., Eur., etc.
— var. alba.

Malvastrum limense (L.), Chili.

Mandragora vernalis, Bert., Orient.

Marrubium astracanicum, Jacq., Caucas.
peregrinum, L., Eur.
vulgare, L., Eur.

Matricaria caucasica, Benth., Caucas.
inodora, L., Eur.
— var. discoidea (DC.).

Matthiola bicornis, DC., Eur.

Meconopsis cambrica, Vig., Eur.
nepalensis, DC., Nepal.
wallichiana, Hook., Himal.

Medicago apiculata, W., Eur.
Echinus, DC., S. Eur.
lappacea, Desr., S. Eur.
littoralis, Rhod., Eur.
lupulina, L., Eur.
marina, L., Eur.
murex, Willd., Eur.
muricata, All., Eur.
orbicularis, Willd., S. Eur.
sativa, L., Eur.
tuberculata, W., Eur.

Melica ciliata, L., Eur., etc.
— var. penicillaris, (Boiss.)
glauca, F. Sz., var. nebrodensis, Parl., Eur.
nutans, L., Eur.

Melilotus alba, Desr., Eur.
officinalis, Desr., Eur.
parviflora, Lam., Eur.

Melittis Melissophyllum, L., Eur.

Mentzelia Lindleyi, T. et G., Calif.

Mercurialis annua, L., Eur.

Mesembryanthemum tricolor, Willd., Cape.
— var. album.

Mimulus cardinalis, Dougl., N. Amer.
cupreus, Veitch., Chili.
glabratus, H. B., Mexico.
luteus, L., N. Amer.
moschatus, Dougl., N. Amer.

Mirabilis Jalapa, L., W. Ind.
longiflora, L., Mexico.

Molinia cærulea, Mœnch, Eur.
— var. variegata.

Monolepis chenopodioides, Moq., N. Amer.

Morina longifolia, Wall., Nepal.

Muscari Argaei, Hort.
armeniacum, Baker, Medit.
atlanticum, Boiss., Spain, Algeria.
conicum, Baker, Campag.
grandifolium, Baker.
Heldreichii, Boiss., Greece.
moschatum, Willd., Caucas.
neglectum, Guss., S. Eur.
racemosum, Mill., Eur.
szovitsianum, Regel, Siber.

Myosotis arvensis, Hoffm., Eur.
cæspitosa, K. F. Sch., Eur.
collina, Hoffm., Eur.
sylvatica, Hoffm., Eur.

Myosurus minimus, L., Eur., etc.

Myrrhis odorata, Scop., Eur.

Nardurus tenellus, Rchb., Spain.

Nardus stricta, L., Eur.

Nemesia floribunda, Lehm., Cape.
pubescens, Benth., Cape.
versicolor, Mey., Cape.

Nemophila aurita, Lindl., Calif.
insignis, Dougl., Calif.
— var. alba, Hort.
— var. grandiflora, Hort.
parviflora, Dougl., N. Amer.

Nicandra physaloides, Gærtn., Peru.

Nicotiana affinis, T. Moore.
Langsdorffii, Weinm., Brazil.
paniculata, L., S. Amer.
rustica, L., S. Eur., etc.
Tabacum, L., S. Amer.

Nigella damascena, L., S. Eur.
sativa, L., S. Eur.

Nolana prostrata, L., Peru, Chili.

Nothoscordum fragrans, Kunth., Amer.

Œnanthe crocata, L., Eur.
globulosa, L., S. Eur.
gymnorrhiza, Brign., C. et S., Eur.
karsthia, Hacq., Carniol.
peucedanifolia, Poll., Eur.
silaifolia, Bbrst., Eur.

Œnothera amœna, Lehm., Calif.
— var. rubicunda, Hort.
biennis, L., N. Amer.
densiflora, Lindl., Calif.
dentata, Cav., N. Amer.
fruticosa, L., N. Amer.
— var. Youngii, Hort.
glauca, Michx., N. Amer.
odorata, Jacq., Patagonia.
pumila, L., N. Amer.
rosea, Ait., N. Amer.
tenella, Cav., Chili, Amer.
triloba, Nutt., N. Amer.

Ocimum basilicum, L., S. Eur.

Ononis arvensis, Mur. Eur.
Natrix, L., S. Eur.
rotundifolia, L., Eur.
spinosa, L., Eur., etc.
— var. alba.
repens, L., Eur.

Onopordon Acanthium, L., Eur.
tauricum, Willd., Eur.
sibthorpianum, Boiss., S. Eur.

Orchis foliosa, Sol., Madeira.
incarnata, L., Eur.
latifolia, L., Eur.
maculata, L., Eur.
— var. superba.

Origanum. vulgare, L., Eur.
— var. album.

Ornithogalum arcuatum, Steven, Cauc.
latifolium, L., Egypt, etc.
narbonense, L., Eur.
orthophyllum, Ten., Italy.
tenuifolium, Guss., Eur.
umbellatum, L., Eur., etc.
— var. Leichtlinii.

Orobanche minor, Sm., Eur.
ramosa, L., Eur.

Oxyria elatior, R. Br., Nepal.

Oxytropis campestris, DC., Eur.
ochroleuca, Bunge, Siber.

Pachypodium erysimoides, Web., N. Amer.

Pæonia arietina, Anders., Orient.
— var. Andersoni.
decora, Anders., Orient.
— var. Pallasii, Hort.
peregrina, Mill., Orient.

Palava flexuosa, Mast., Peru.

Panicum Crus-galli, L., S. Eur.

Papaver apulum, Ten., Eur.
Argemone, L., Eur.
dubium, L., Eur.
— var. Lecoqii (Lamotte), Eur.
gariepinum, Burch., S. Afr.
glaucum, Boiss., Orient.
lateritium, C. Koch., Armen.
nudicaule, L., Alps.
— var. album.
orientale, L., Orient.
— var. bracteatum, (Lindl.)
— var. majus.
pavoninum, C. A. Mey., Afghan.
persicum, Ldl., Persia.
pilosum, Sibth., Greece.
— var.
Rhœas, L., Eur.
— var. Hookeri, (Baker).
— var. "Shirley."
rupifragum, Boiss., Spain.
— var. atlanticum, Ball, G. Atlas.
somniferum, L., China, etc.
— var. "Danebrog."
— var. fl. pl.
— var. setigerum, (DC.)

Parietaria lusitanica, L., Eur.
officinalis, L., Eur.

Parnassia nubicola, Hook. fil., Himalaya.
palustris, L., Eur.

Pentstemon barbatus, Nutt., N. Amer.
— var. Torreyi, Gray.
cæruleus, Gray., N. Amer.
confertus, Dougl., N. Amer.
diffusus, Dougl., N. Amer.
glaber, Pursh., N. Amer.
Hartwegii, Benth., Mexico.
lævigatus, Sol., var. Digitalus, Gray., N. Amer.
ovatus, Dougl., N. Amer.
pubescens, Sol., N. Amer.

Perezia multiflora, Less., Peru, etc.

Petroselinum sativum, Hoffm., Eur.

Petunia nyctaginiflora, Juss., La Plata.

Peucedanum Ostruthium, K., Eur.
parisiense, DC., Eur.
paucifolium, Ledeb., Siber.
sativum, Benth., Eur.

Phaca oroboides, DC., Eur.

Phacelia campanularia, Gray., Calif.
divaricata, Gray., Calif.
Parryi, Torr., Calif.
tanacetifolia, Bth., Calif.
viscida, Torr., Calif.
Whitlavia, Gray., Calif.
— var. alba, Hort.

Phalaris canariensis, L., S. Eur.
paradoxa, L., S. Eur.
tuberosa, L., Eur.

Phaseolus multiflorus, Lam.
ricciardianus, Ten.
tuberosus, Lour., Cochinchina.
vulgaris, L., India.
wightianus, Grah., India.

Phleum asperum, Jacq., Eur.
Bœhmeri, Wib., Eur.
pratense, L., Eur.
— var. nodosum, (L.)

Phlomis russeliana, Lagas., Orient.
umbrosa, Turcz., Siberia.

Phlox Drummondi, Hook., Calif.
— var. cuspidata.
stellaria, Gray., N. Amer.

Physalis Alkekengii, L., Eur.

Physostegia virginiana, Benth., var. speciosa, Gray., N. Amer.

Phyteuma Halleri, All., S. Eur.
limonifolium, Sibth. et Sm., Eur.
Michelii, All., Eur.
nigrum, Schmidt, Germ.
orbiculare, L., Eur.
spicatum, L., Eur.

Phytolacca acinosa, Roxb., India.

Picridium tingitanum, Dsf., Eur.

Pimpinella Anisum, L., Eur.

Pisum sativum, L., Eur.

Plantago arenaria, L., Eur.
Coronopus, L., Eur.
Cynops, L., Eur.
Ispaghula, Roxb., India.
lagopus, L., Eur.
lanceolata, L., Eur.
major, L., Eur.
maritima, S., Eur.

Platycodon grandiflorum, A.DC., Siber.
— var. Mariesii, Hort.

Platystemon californicus, Benth., Calif.

Pleurospermum pulchrum, Aitch. et Hemsl., Afghan.

Poa alpina, L., Eur.
— var. badensis, Hke.
compressa, L., Eur.
glauca, Sm., Eur.
pratensis, L., Eur.
sudetica, Haenke, Eur.
trivialis, L., Eur.
violacea, Bell., Eur.

Podophyllum Emodi, Wall., Himal.

Polemonium cæruleum, L., Eur., Amer., etc.
— var. album, Hort.
flavum, Greene, Amer.
himalayanum, Baker, Himal.
pauciflorum, Wats., Mexico.
reptans, L., N. Amer.

Pollinia Gryllus, Spr., Eur.

Polygonatum verticillatum, All., Eur.

Polygonum aviculare, L., Eur.
Bistorta, L., Eur.
capitatum, Don., Himalayas.
molle, Don., Himal.
viviparum, L., Eur.
Weyrichii, F. Schm., Sachal. Isl.

Polypogon monspeliensis, Dsf., Eur.

Potentilla alchemilloides, Lap., Pyrenees.
argyrophylla, Wall., Himal.
chinensis, Ser., China.
collina, Wib., Eur.
crocea, Hall f., Eur.
Detommasii, Ten., Eur.
digitata × flabellata.
glandulosa, Ldl., Calif.
heptaphylla, Mill., Eur.
kotschyana, Fenzl., Kurdistan.
kurdica, Boiss., Orient.
leschenaultiana, Ser., Ind., Or.
malacophylla, Bunge., Orient.
montenegrina, Panc., Montenegro.
nepalensis, Hook., Nepal.
nevadensis, Boiss., Spain.
pedata, Willd., France.
pennsylvanica, L., N. Amer.
— var. arachnoidea, Lehm.
pseudo-chrysantha.
pyrenaica, Ram., Pyren.
recta, L., Eur., Caucas.
— var. laciniata.
— var. macrantha, (Leab.)
— var. palmata.
rupestris, L., Eur.
schrenkiana, Regel.
semi-argentea, Hort. ×.
semi-laciniata, Hort. ×.
Sibbaldia, Haller fil., Himal.
Thurberi, Gray., N. Amer.
Visianii, Panc., Eur.
wrangeliana, Fisch., Siberia.

Poterium canadense, B. et H., N. Amer.
Sanguisorba, L., Eur.

Primula clusiana, Tsch., Eur.
denticulata, Sm., Himal.
floribunda, Wall., Himal.
involucrata, Wall., Himal.
japonica, Gray, Japan.
mollis, Nutt., Bootan.

Primula—*cont*
obconica, Hance, China.
rosea, Royle, Himal.
verticillata, Forsk., Arabia.

Prunella grandiflora, L.,Eur.Cauc.
var. laciniata,Hort.
— var. rubra, Hort.
vulgaris, L., Eur.

Psoralea macrostachya, DC., N. Amer.
physodes, Dougl., N. Amer.

Pyrrhopappus carolinianus, DC., Florida, Texas.

Ramondia pyrenaica, Rich., Pyrenees.

Ranunculus abortivus, L.,N. Amer.
Broteri, Freyn., Spain.
acris, L., Eur.
arvensis, L., Eur.
brutius, Tenore, Italy.
cassius, Boiss., Taurus.
caucasicus, M.B., Caucas.
chærophyllus, L., Eur., etc.
Cymbalaria, Pursh, N. Amer.
falcatus, L., Eur.
muricatus, L., Eur.
parviflorus, L., Eur.
repens, L., Eur.
trachycarpus, F. et M., Orient.

Raphanus sativus, L., Eur.

Rapistrum linnæanum, All., Eur.

Reseda abyssinica, Fres., Abyss.
alba, L., S. Eur.
glauca, L., Pyren.
lutea, L., Eur.
Luteola, L., Eur.

Rhagadiolus stellatus, Gærtn., S. Eur.

Rheum collinianum, Baillon.
Emodi, Wall., Himal.
macropterum, Mart.
officinale, Baill., Thibet.
palmatum, L., Ind., etc.
— var. tanghuticum.
Rhaponticum, L., Siber.
rugosum, Desf., Ind. Or.
Tranzenbachii, Hort. Berlin.
undulatum, L., Siberia, etc.
webbianum, Royle., India.

Rudbeckia amplexicaule, Vahl., N. Amer.
bicolor, Nutt., N. Amer.
columnaris, Pursh, var. pulcherrima, Don., N. Amer.
fulgida, Ait., N. Amer.
hirta, L., N. Amer.
occidentalis, Nutt., N. Amer.
purpurea, L., N. Amer.

Rumex alpinus, L., Eur.
Brownii, Campd., Austral.
nepalensis, Spr., Himal.
obtusifolius, L., Eur.
— var. sylvestris, (Wallr.)
Patientia, L., S. Eur.
pulcher, L., Eur.
purpureus, Poir., Eur.
salicifolius, Weinm., N. Amer.
vesicarius, L., N. Afr.

Ruta graveolens, L., Eur.

Sagina glabra, Willd., S. Eur.
— var. pilifera.
Linnæi, Presl., Eur.

Salvia æthiopis, L., Eur.
argentea, L., Medit.
Beckeri, Trautv., Caucas.
glutinosa, L., Eur.
Horminum, L., S. Eur.
— var. bracteis violaceis.
hians, Royle., Ind.
interrupta, Schousb., Marocco.
napifolia, Jacq., S. Eur.
nutans, L., Transyl.
pratensis, L., Eur.
— var. alba.
— var. Baumgarteni, Grsb., Transs.
— var. rosea.
Sclarea, L., S. Eur.
sylvestris, L., var. alba., Eur.
tiliæfolia, Vahl., Mexico.
Verbenaca, L., Eur.
verticillata, L., Eur.

Sanvitalia procumbens, Lam., Mexico.

Saponaria orientalis, L., Orient.

Satureja hortensis, L., Taur., Caucas.
montana, L., S. Eur.

Saxifraga altissima, Kerner, Eur.
aphylla, Sternb., Eur.
— var. leptophylla.

- Saxifragra—*cont.*
  - Aizoon, L., Eur., Alps.
  - — var. Churchillii, Kern.
  - — var. Gaudinii.
  - — var. incrustata.
  - — var. infracta.
  - — var. Malyi.
  - — var. minor.
  - — var. pygmæa.
  - — var. recta, (Lap.)
  - — var. rotata.
  - — var. rosularis, Schleich.
  - cæspitosa, L., Eur., etc.
  - — var. decipiens, (Ehrh.)
  - — var. hirta, (Don.)
  - — var. sedoides, (L.)
  - cartilaginea, Willd., Caucas.
  - Cotyledon, L., Eur., Alps.
  - — var. pyramidalis, (Lap.)
  - crustata, Vent., Alps.
  - granulata, L., Eur.
  - Hostii, Tausch, Alps.
  - — var. macnabiana, Hort.
  - — var. tristis.
  - kolenatiana, Regel, Siberia.
  - lactea, Turcz., Temp. Asia.
  - lingulata, Bell., Marit. Alps.
  - — var. lantoscana, (Boiss.)
  - longifolia, Lap., Pyrenees.
  - muscoides, Wulf., Eur.
  - — var. pygmæa, (Haw.)
  - Prostii, Sternb., Eur.
  - rocheliana, Sternb., Bosnia.
  - — var. coriophylla, (Griseb.)
  - rotundifolia, L., Eur.
  - — var. hirsuta.
  - sponhemica, Gm., var. hirta, Don., Eur.
  - tenella, Wulf., Alps.
  - trifurcata, Schrad., N. Spain.
  - umbrosa, L., Eur.
  - valdensis, DC., Savoy, Alps.
- Scabiosa arvensis, L., Eur.
  - atropurpurea, L., Eur.
  - caucasica, Bbrst., Cauc.
  - — var. amœna, (Jacq.)
  - Columbaria, L., Eur.
  - graminifolia, L., Eur.
  - gramuntia, L., Eur.
  - integrifolia, Wulf., Eur.
  - lucida, Vill., Eur.
  - micrantha, Dsf., Maced.
  - palæstina, L., Syria, etc.
  - Portæ, Huter., Eur.
  - stellata, L., Eur.
  - vestina, Facch., Tyrol.
- Scandix Balansæ, Reut., Orient.
  - brachycarpa, Guss., Sicily.
  - macroryncha, C. A. Mey., Eur.
  - Pecten-Veneris, L., Eur.
- Schismus marginatus, Beauv., S. Eur.
- Schizanthus pinnatus, R. et P., Chili.
- Schizopetalum Walkeri, Sims, Chili.
- Scilla campanulata, Ait., Spain, etc.
  - — var. alba, Hort.
  - — var. rubra.
  - chinensis, Benth., China.
  - lingulata, Poir., Eur.
  - nonscripta, Hoffm., Eur.
  - verna, Huds., W. Eur.
- Scirpus setaceus, L., Eur.
- Scleranthus annuus, L., Eur.
  - perennis, L., Eur.
- Scorpiurus vermiculata, L., Eur.
- Scrophularia aquatica, L., Eur.
  - Ehrhartii, Stev., Caucas.
  - nodosa, L., Eur.
  - vernalis, L., Eur.
- Scopolia lurida, Dub., Himal.
- Scutellaria alpina, L., Eur.
  - altissima, L., Caucas.
  - galericulata, L., Eur.
  - macrantha, Fisch., Siberia.
- Secale Cereale, L., Asia Minor.
  - — var. villosum.
- Sedum Aizoon, L., Siberia.
  - Ewersii, Ledeb., Siber.
  - glaucum, W. et K., Eur.
  - magellense, Ten., Italy.
  - middendorfianum, Max., Siberia.
  - Rhodiola, DC., Siber.
  - stellatum, L., Eur.
  - villosum, L., Eur.
- Selinum Candollei, DC., Nepal.
- Sempervivum boutignyanum, Bill., Pyrenees.
  - mettenianum, Lehm., Switz.
  - montanum, L., Alps.
- Senecio artemisiæfolius, Pers., S. Eur.
  - Clusii, Schultz., Eur.
  - Doria, L., Eur.
  - Doronicum, L., Eur.
  - elegans, L., Cape.

Senecio—*cont.*
— var. alba.
— var. purpurea.
japonicus, Sch., Japan.
macrophyllus, Bbrst., Caucas.
thyrsoideus, DC., Siberia.
viscosus, L., Eur.

Serratula coronata, L., Siberia.
— var. macrophylla.
Gmelinii, Ledeb., Caucas.
quinquefolia, Bbrst., Caucas.
tinctoria, L., Eur.

Seseli gummiferum, Sm., Greece.

Setaria glauca, Beauv., Eur.
italica, Beauv., Eur.
macrochæta, Link, Eur., Asia, etc.
verticillata, P.B., Eur.
viridis, Beauv.

Sherardia arvensis, L., Eur.

Sicyos Baderoa, Hk. et Arn., Chili.

Sidalcea malvæflora, Gr., Amer.

Sideritis scordioides, L., Eur.

Silene alpestris, Jacq., Alps.
Armeria, L., Eur.
— var. compacta, (Hornem.)
chloræfolia, Sm., var. swertifolia, Armenia.
Chouleti, Coss., Eur.
ciliata, Pourr., Crete.
clandestina, Jacq., Cape.
colorata, Poir., Mediter.
conoidea, L., Levant, etc.
cretica, L., Eur.
Cucubalus, Wibel., Eur.
diurniflora, Kunze, Cape.
echinata, Otth., Italy.
fimbriata, Sims., Crete, etc.
Fortunei, Vis., China.
fusca, Link, Portugal.
gallica, L., Eur.
glauca, Pourr., Eur.
gracilis, DC.
italica, Pers., Eur.
juvenalis, Del., Egypt.
linicola, Gmel., Germany.
longicilia, Otth., Portugal.
maritima, With., Eur.
nutans, L., Eur.
obtusifolia, Willd., Italy.

Silene—*cont.*
paradoxa, L., S. Eur.
pendula, L., Sicily, etc.
Persoonii, Tod. non Schott.
pseudo-atocion, Desf., N. Afr.
quadrifida, L., Eur.
rubella, L., Eur., N. Afr.
Sartori, Boiss., Greece.
Saxifraga, L., Eur.
sedoides, Jacq., Europe.
tatarica, Pers., Tatar.
tenuifolia, Otth., Dahur.
vallesia, L. Eur.
vesiculifera, Gay, S. Eur.
vespertina, Retz., S. Eur.
Zawadskii, Herbich, Austria.

Silphium perfoliatum, L., N. Amer.
scaberrimum, Ell., N. Amer.
trifoliatum, L., N. Amer.

Silybum eburneum, Coss. et Dur., Eur.
marianum, Gærtner, Eur.

Sisymbrium Alliaria, Scop., Eur.
assoanum, Losc., Eur.
austriacum, Jacq., S. Eur.
myriophyllum, H. B. K., Quito.
officinale, Scop., S. Eur.
polyceratium, L., Eur.
Sophia, L., Eur.
strictissimum, L., Eur.

Sisyrinchium bermudianum, L., Bermuda.

Sium angustifolium, L., Eur.

Smyrnium Olusatrum, L., Eur.

Solanum Dulcamara, L., Eur.
guineense, Lam., Trop. Afr., etc.
villosum, Lam., Eur.

Solidago canadensis, L., N. Amer.

Sonchus asper, Hoffm., Eur.
oleraceus, L., Eur.
palustris, L., Eur.

Specularia falcata, A.DC., Mediter.
— var. castellana, Lange.
pentagonia, A.DC., Orient.
perfoliata, DC., N. Amer.
Speculum, A.DC., Eur.

Spergula arvensis, L., Eur.

Spiræa astilboides, Hort.
Aruncus, L., N. Amer.
palmata, Thunb., Japan.
Ulmaria, L., Eur.

Stachys alpina, L., Eur.
— var. intermedia.
Betonica, Benth., Eur.
— var. alba.
grandiflora, Bth., Caucas., etc.
spinulosa, Sib. et Sm., Greece.
setifera, Mey., Caucas.
sylvatica, L., Eur.

Statice bellidifolia, Gouan., Eur.
densiflora, Guss., Eur.
Gmelinii, Willd., Eur.
gougetiana, Girard, Spain.
Limonium, L., Eur.
lychnidifolia, Gir., S. Eur.
Suworowii, Regel, Turkestan.
Thouini, Viv., S. Eur.
tomentella, Boiss., Eur., etc.

Stipa pennata, L., Eur., etc.

Swertia perennis, L., Eur. Cauc.

Symphyandra Wanneri, Heuff., Eur.

Symphytum officinale, L., Eur.

Syrenia lamarckiana, Andrz., Russia, Siberia.

Tagetes lucida, Cav., Mexico.
patula, L., Mexico.
pusilla, H.B., Quito.

Tamus communis, L., Eur.

Taraxacum corniculatum, DC., Eur.
gymnanthum, DC., Eur.

Tellima grandiflora, R.Br., N. Amer.

Tetragonia crystallina, L'Herit., Peru.
expansa, Murr., Austral.

Tetragonolobus purpureus, Mœnch, S. Eur.

Teucrium Chamædrys, L., Eur.
— var. aurea.
hyrcanicum, L., Caucas.
multiflorum, L., Orient.
Scorodonia, L., Eur.
—var. variegatum.

Thalictrum angustifolium, Jacq., S. Eur.
— var. (T. nigricans, DC.), Eur.
aquilegifolium, L., Eur., etc.
— var. purpureum.
flavum, L., Eur.
— var. sphærocarpum, Lej.
glaucum, Desf., S. Eur.
javanicum, Blume, Java.
minus, L., Eur.
— var. affine, (Jord.)
— var. elatum, Regel.
trigynum, Fisch., Dahur.

Thelesperma folifolium, Gray, N. Amer.

Thermopsis lanceolata, R.Br., Siberia.
montana, Nutt., N. Amer.

Thlaspi alliaceum, L., Eur.
arvense, L., Eur.
alpestre, L., Eur.
præcox, Wulf., Austria.

Thrincia hirta, DC., Eur.

Thymus comosus, Heuff., Transs.
Serpyllum, L., Eur.

Tofieldia calyculata, Whlnb., Eur.

Tovaria racemosa, Neck., N. Amer.
stellata, Neck., N. Amer.

Tournefortia heliotropioides, Hook., Buen. Ayres.

Trachymene cœrulea, Graham, Austral.
pilosa, Sm., Austral.

Tradescantia erecta, Jacq., Mexico.

Tragopogon majus, Jacq., Eur.
orientale, L., Eur., etc.

Trifolium agrarium, L., Eur.
badium, Schreb., Eur.
diffusum, Ehrh., Eur.
gemellum, Pourr., Eur.
incarnatum, L., Eur.
Lagrangei, Boiss., Orient.
leucanthum, Bbrst., Taurus.
minus, Sm., Eur.
multistriatum, Koch, Eur.
pannonicum, L., Eur., etc.
Perreymondi, Gren., France.
pratense, L., Eur.
repens, L., Eur.
resupinatum, L., Eur.

Trifolium—*cont.*
rubens, L., Eur.
squarrosa L., S. Eur.
tomentosum, L., Eur.

Triglochin maritimum, L., Eur.

Trigonella corniculata, L., S. Eur.
cretica, Boiss., Crete.
fœnum-græcum, L., S. Eur.
ovalis, Boiss., Spain.
polycerata, L., Eur.

Trinia Hoffmanni, Bbrst., Eur., etc.
Kitaibellii, Bbrst., Russia, etc.

Tripteris cheiranthifolia, Schultz., Abyss.

Triticum caninum, L., Eur.
chinense, Trin., N. China.
desertorum, Fisch., Russia.
durum, Desf., S. Eur., N. Afr.
monococcum, L., Eur.
ovatum, G. et G., Eur.
violaceum, Horn., Eur.

Tritonia crocosmaeflora, Garden Hybrid.
Pottsii, Benth., Cape.

Trollius asiaticus, L., Siber.
europæus, L., Eur.

Tropæolum aduncum, Sm., Peru.
majus, L., Peru.
minus, L., Peru.
tuberosum, R. et P., Peru.

Troximon glaucum, Nutt., N. Amer.
var. laciniatum, Gray.

Tunica illyrica, Boiss., Eur.

Urospermum Dalechampii, Desf., Eur.
picroides, Desf., S. Eur.

Ursinia pulchra, N. E. Brown, Cape.
— var. sulphurea, Hort., Kew.

Urtica dioica, L., Eur.
membranacea, Poir., Eur.
pilulifera, L., Eur.
— var. balearica, L.

Valeriana alliariæfolia, Vahl, Caucas.
— var. intermedia.
montana, L., Eur.

Valeriana—*cont.*
officinalis, L., Eur.
var. exaltata, (Mikan.)
— var. sambucifolia, (Mikan.)
Phu, L., S. Eur.

Valerianella Auricula, DC., Eur.
carinata, Loisl., S. Eur.
eriocarpa, Desv., Eur.

Venidium fugax, Harv., Cape.

Veratrum album, L., Eur.
nigrum, L., Eur.
viride, Ait., N. Amer.

Verbascum Blattaria, L., Eur.
phœniceum, L., Eur. Siber.
pyramidatum, Bbrst., Caucas.
speciosum, Schrad., Eur.
thapsiforme, Schrad., Eur.

Verbena Aubletia, L., N. Amer.
bonariensis, L., S. Amer.
caroliniana, Med., N. Amer.
officinalis, L., Eur.
venosa, Gill. et Hook., Buenos Ayres.

Vernonia altissima, Nutt., N. Amer.

Veronica agrestis, L., Eur.
aphylla, L., Eur.
austriaca, L., Eur.
— var. pinnatifida.
exaltata, Maud., Siber.
gentianoides, Vahl., Taur.
incana, L., Russia.
incisa, Ait., Siber.
longifolia, L., Eur.
— var. alba.
— var. mollis.
— var. rosea.
— var. subsessilis.
Lyallii, Hk. f., N. Zeal.
officinalis, L., Eur.
repens, Clar., Corsica.
saxatilis, L., Eur.
serpyllifolia, L., Eur.
spicata, L., Eur.
taurica, Willd., Taur.
Teucrium, L., Eur.
— var. latifolia, (L.)
virginica, L., N. Amer.
— var. japonica, (Steud.)

Vesicaria corymbosa, Hort.
cretica, Poir., Crete.
edentula, Poir., Eur.
grandiflora, Hook., Texas.

Vicia amphicarpa, Dorth., France.
calcarata, Desf., Algiers.
cassubica, L., S. Eur.
Cracca, L., Eur.
disperma, DC., France.
Ervilia, Willd., S. Eur.
Faba, L., cultivated.
— var. equina, (Pers.)
fulgens, Hort.
macrocarpa, Bert., Eur.
narbonensis, L., S. Eur.
pannonica, Cr., Eur.
pyrenaica, Pourr., Pyren.
sativa, L., Eur., etc.
— var. morisiana, (Jord.)
sepium, L., Eur.
sicula, Guss., Eur.
sylvatica, L., Eur.
unijuga, A. Braun., Siberia.
villosa, Roth., S. Eur.

Vincetoxicum fuscatum, Rch. f., Eur.
nigrum, Michx., Eur.

Viola cornuta, L., Eur.
— var. alba.
elatior, Fr., Eur.
Jooi, Janka, Transylv.
Viola—*cont.*
lactea, Sm., Eur.
odorata, L., Eur.
palustris, L., Eur.
reichenbachina, Bor. Eur.
striata, Ait., N. Amer.
sylvatica, L., Eur.
tricolor, L., Eur.

Wahlenbergia graminifolia, A.DC., Dalm.

Xanthium indicum, Wall., Ind., etc.
strumarium, L., Eur.

Xanthocephalum gymnospermoides, B. et Hk. f., Arizona.

Zinnia elegans, Jacq., Mexico.
multiflora, L., Mexico.
pauciflora, L., N. Amer.

Ziziphora capitata, L., Taur., etc.

Zollikoferia elquinensis, Phil., Chili.

Zygadenus elegans, Pursh., N. Amer.

TREES AND SHRUBS.

Acer campestre, L.
— var. hebecarpum, Hort.
circinatum, Pursh., N.W. Amer.
Pseudo-Platanus, L., Eur., etc.
— var. euchlorum.
— var. purpureum, Hort.

Ailantus glandulosus, Desf., Japan.

Alnus cordifolia, Ten., Italy.
firma, S. et Z., Japan.
glutinosa, Gærtn.
— var. rubronervia, Hort.
— var. sorbifolia, Hort.
Alnus—*cont.*
incana, Will., N. Hemisphere.
— var. laciniata, Hort.
japonica, S. et Z., Japan.
serrulata, Willd., N. Am.
— var. latifolia, Hort.

Amelanchier Botryapium, DC.
vulgaris, Mœnch, Europe.
— var. cretica.

Amorpha fruticosa, L., N. Amer.

Aralia edulis, S. et Z., Japan.
spinosa, L., N. America.

Aucuba japonica, Thunb.
vera, Hort.

Azalea rhombica, Regel, Japan.

Berberis buxifolia, Lamk., Chili.
stenophylla, Hort.
virescens, Hook. f., Himalaya.
vulgaris, L., Eur., etc.
— var. purpurea, Hort.
wallichiana, DC., Himal.

Betula alba, L., N. Hemisph.
— var. Youngii, Hort.
Ermanni, Cham., N. Asia.
lutea, Michx. f., N. Amer.
populifolia, Ait., U. S. Amer.

Buddleia japonica, Hemsl., Japan.

Biota orientalis, End., Orient.
— var. gracilis, Hort.
— var. intermedia, Hort.
— var. pyramidalis, Hort.

Caragana arborescens, Lamb., Siberia.
frutescens, DC., Siberia.
pygmæa, DC., Siberia.
Redowskii, DC., Siberia.

Carpinus Betulus, L., Eur., etc.

Cedrus Deodara, Loud., Himalaya.

Celastrus scandens, L., N. Amer.

Celtis occidentalis, L., N. Amer.

Cephalostachyum capitatum, Munro, Sikkim.

Cerasus lusitanica, Lobel, Portugal.

Chamæcyparis (Cupressus).
Lawsoniana, Parl., Calif.
obtusa, S. et Z., Japan. (Retinospora obtusa.)

Cistus laurifolius, L., Spain.

Cladrastis amurensis, Benth. et Hook., Amur.

Clematis erecta, L., Europe, etc.
Flammula, L., S. Eur.
integrifolia, L., S. Eur.

Colutea arborescens, L., Eur.
— var. cruenta, (Ait.)
— var. haleppica, (Lamk.)

Cornus alba, L., N. Amer.
alternifolia, L. f., N. Amer.
circinata, Herit., N. Amer.
paniculata, L'Herit.,N. Amer.
sanguinea, L., Eur.
sericea, L., N. Amer.
sibirica, Lodd., Siberia, etc.

Cotoneaster acuminata, Lindl., Himal.
bacillaris, Wall., Himal.
— var. floribunda, Hort.
— var. obtusa, Hort.
buxifolia, Wall., Himal.
Fontanesi, Spach.
frigida, Wall., Himal.
horizontalis, Dcne.
laxiflora, Lind., India.
microphylla, Wall., Himal.
reflexa Carr., China.
rotundifolia, Wall., Himal.
Simonsii, Baker., Himal.
tomentosa, Lindl., Eur.

Cratægus Carrierei, Vauvel. (C. Lavallei, Herincq.)
coccinea, L., N. Amer.
— var. acerifolia, Hort.
— var. glandulosa, Hort.
— var. indentata, Hort.
— var. Kelmanni, Hort.
cordata, Mill., N. Amer.
Crus-Galli, L., N. Amer.
— var. pruinosa.
Downingii, Hort.
flava, Ait., N. Amer.
orientalis, Pall., Orient.
Oxyacantha, L., Eur.
— var. fusca, Hort.
— var. Gumperi bicolor, Hort.
parvifolia, Ait., N. Amer.
punctata, Jacq., N. Amer.
— var. brevispina, Hort.
— var. striata, Hort.
Pyracantha, Pers., var. Lalandii, Hort.
tanacetifolia, Pers., Orient.
tomentosa, L., N. Amer.

Cupressus nootkatensis Lamb., N.W. Amer.
Thyoides, L., N. Amer.

Cytisus albus, L., S.W. Eur.
— var. incarnatus, Hort.
biflorus, L., Herit., Eur.
calycinus, Bieb., Caucasus.
capitatus, Jacq., S. Eur.
hirsutus, L., E. Eur.
leucanthus, W. et K., E. Eur.
× præcox, Hort.
monspessulanus, S. Eur.
nigricans, L., Eur.
purpureus, Scop., E. Eur.
scoparius, L., Eur.

Cytisus—*cont.*
— var. Andreanus.
— var. pendula, Hort.
sessilifolius, L., Eur.

Dabœcia polifolia, D. Don., W. Eur.
— var. alba.
— var. versicolor.

Deutzia crenata, S. et Z., Japan.
— var. Sieboldii, Hort.
scabra, Thunb., Japan.

Elæagnus longipes, A. Gray., Japan.
umbellata, Thunb., Japan.

Erica cinerea, L., Eur.
— var. alba.
— var. grandiflora.
— var. pallida.
— var. purpurea.
— var. rosea.
stricta, Andr., S. Eur.

Euonymus europæus, L., Eur.
— var. coccineus, Hort.
latifolius, Scop., Eur.

Forsythia suspensa, Vahl., Japan.

Fraxinus Ornus, L., Eur.
— var. latifolia, Hort.
— var. rotundifolia, Hort.

Garrya eliptica, Dougl., California.

Gaultheria Shallon, Pursh, N. Amer.
procumbens, L., N. Amer.

Genista ætnensis, DC., Sicily.
radiata, Scop., S. Eur.
sagittalis, L., Eur.
virgata, DC., Madeira.

Hamamelis virginica, L., N. Amer.

Hedera Helix, L., Eur., etc.

Hippophae rhamnoides, L., Eur., etc.

Hypericum Androsæmum, L., Eur.
densiflorum, Pursh, N. Amer.
elatum, Ait., N. Amer.
galioides, Lamk., N. Amer.

Ilex Aquifolium, L., Eur.
— var. platyphylla, Hort.
verticillata, Gray, N. Amer.

Kalmia glauca, Ait., N. Amer.
latifolia, L., N. Amer.

Laburnum alpinum, Griseb., Eur.
Alschingeri, Vis., E. Eur.
vulgare, Griseb., Eur.
— var. Carlieri, Hort.
— var. involutum, Hort.
— var. Parkesi, Hort.
— var. quercifolium.
— var. sessilifolium.

Ledum latifolium, Ait., N. Amer.

Leucothöe Catesbæi, Gray, N. Amer.
racemosa, Gray, N. Amer.

Leycesteria formosa, Wall., Himal.

Ligustrum medium, Fr., Japan.

Lonicera Morrowii, Gray, Japan.
occidentaliis, Steud., N. Amer.
orientalis, Lam., Asia Minor.
Sullivantii, N. Amer.
Xylosteum, L., Eur.

Lyonia ligustrina, DC., N. Amer.

Magnolia tripetala, L., N. Amer.

Mahonia Aquifolium, Nutt., N. Amer.
— var. murrayana, Hort.
fascicularis, DC., N. Amer.

Menispermum canadense, L., N. Amer.

Mespilus Smithii, DC., Caucasus.

Morus nigra, L., Eur.

Myrica cerifera, L., United States.

Neillia amurensis (Spiræa, Maxim.), Amurland.
opulifolia, Benth. et Hook., N. Amer.

Olearia Haastii, Hook. fil., N. Zeal.

Ostyra japonica, Japan.

Paulownia imperialis, S. et Z., Japan.

Pernettya mucronata, Gaud., Chili, etc.

Photinia villosa, Dcne., Japan.

Pinus Peuce, Griseb., Macedonia.

Piptanthus nepalensis, Sweet, Himalaya.

Prunus pumila, L., N. Amer.

Ptelea trifoliata, L., N. Amer.
— var. aurea, Hort.
— var. mollis.

Pyrus americana, DC., N. Amer.
Aria, Ehrh., Europe, etc.
— var. angustifolia.
— var. græca, Boiss.
— var. salicifolia.
arbutifolia, L., N. Amer.
— var. grandiflora, Hort.
— var. serotina, Lindl.
Aucuparia, Gærtn., Eur.
— var. saturejifolia.
baccata, L., Asia.
domestica, Sm., var. maliformis.
floribunda, Sieb., Japan.
intermedia, Ehrh., Europe.
japonica, Thunb., Japan.
latifolia, Syme, Eur.
Maulei, Masters, Japan.
— var. superba, Hort.
nivalis, Jacq., Asia Minor.
pinnatifida, Ehrh., Eur.
Ringo, Max., Japan, etc.
spectabilis, Desf., China, etc.

Rhododendron arboreum, Sm., Sikkim.
campanulatum, Don, Sikkim.
ciliatum, Hook. f., Sikkim.
Wightii, Hook. f., Sikkim.

Rhodotypus kerrioides, S. et Z., Japan.

Rhus glabra, L., N. Amer.
radicans, L., N. Amer.

Ribes alpinum, L., Eur.
aureum, Pursh., N.W. Amer.
sanguineum, Pursh., N.W. Amer.
— var. atrosanguineum, Hort.
— var. glutinosum, Benth.

Rosa acicularis, Lindl., Japan, etc.
agrestis, Savi, Eur.
alpina, L., Eur., var. inermis.
Bakeri, Déségl., England.
blanda, Ait., N. Amer.
californica, Ch. et Sch., Calif.
canina, L., Eur., etc.
— var. andegavensis, Baker.
carolina, L., N. Amer.
cinnamomea, L., Eur., etc.
hibernica, Sm., Britain.

Rosa—*cont.*
lucida, Ehrh., N. Amer.
microphylla, Roxb., China.
moschata, Mill., India, etc.
multiflora, Thunb., Japan.
nitida, Willd., N. Amer.
nutkana, Presl, N. Amer.
omissa, Déségl., Eur.
pisocarpa, A. Gray, N. Amer.
rubiginosa, L., Europe, etc.
— var. major, Hort.
rubrifolia, Vill., Eur.
rugosa, S. et Z., Japan.
— var. alba.
sericea, Lindl., Himal.
spinosissima, L., Eur.
— var. cistiflora, Hort.
— var. picta, Hort.
— var. rubra, Hort.
Wilsoni, Bor., Britain.

Rubus echinatus, Lindl., Britain.
laciniatus, Willd., Hort.
leucostachys, Sm., Eur.
lindleyanus, Lees, Britain.
mucronatus, Borr., Britain.
occidentalis, L. et N., Amer.
rhamnifolius, W. et N., Eur.
ulmifolia, Schott (R. discolor, W. et N.), Eur.

Sambucus nigra, L., Eur., etc.
— var. leucocarpa.
— var. swindonensis, Hort.
— var. virescens, Hort.

Skimmia Fortunei, Mast. (S. japonica, Hort.)

Smilax excelsa, L., Orient.
rotundifolia, L., N. Amer.

Spartium junceum, L., S. Eur.

Spiræa brumalis, Lange.
carpinifolia, Pall., Eur.
Douglasii, Hook., N.W. Amer.
japonica, L. fil., Japan.
— var. glabra, Hort.
— var. typica.
lindleyana, Wall., Himal.
luxurians, Lavallée (S. pruinosa, Hort.
paniculata, L.
salicifolia, L., N. Amer.
sanssouciana, Hort.
splendens, Hort.

Symphoricarpus racemosus, Michx. N. Amer.

Syringa pekinensis, Rupr., China.
    vulgaris, L., Orient.

Taxus baccata, L., Eur., etc.
    — var. Dovastonii, Hort.
    — var. fructu-luteo, Hort.
    — var. Washingtoni, Hort.

Ulex europæus, L., Eur.

Vaccinium maderense, Link., Azores.
    stamineum, L., N. Amer.

Viburnum cassinoides, N. Amer.
    dilatatum, Thunb., Japan.

Viburnum—*cont.*
    Lantana, L., Eur.
    — var. burejæticum.
    Opulus, L., Eur., etc.

Vitis heterophylla, Thunb., Japan.
    — var. humulœfolia.
    Labrusca, L., N. Amer.

Zenobia speciosa, D. Don., U. S. Amer.
    — var. pulverulenta.

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

APPENDIX II.—1894.

NEW GARDEN PLANTS OF THE YEAR 1893.

The number of garden plants annually described in botanical and horticultural publications, both English and foreign, is now so considerable that it has been thought desirable to publish a complete list of them in the *Kew Bulletin* each year. The following list comprises all the new introductions recorded during 1893. These lists are indispensable to the maintenance of a correct nomenclature, especially in the smaller botanical establishments in correspondence with Kew, which are, as a rule, only scantily provided with horticultural periodicals. Such a list will also afford information respecting new plants under cultivation at this establishment, many of which will be distributed from it in the regular course of exchange with other botanic gardens.

The present list includes not only plants brought into cultivation for the first time during 1893, but the most noteworthy of those which have been re-introduced after being lost from cultivation. Other plants included in the list have been in gardens for several years, but either were not described or their names had not been authenticated until recently.

In addition to species and botanical varieties, all hybrids, whether introduced or of garden origin, but described for the first time in 1893, are included. It has not been thought desirable, however, to give authorities after the names of garden hybrids in such genera as Cypripedium, &c. Mere garden varieties of such plants as Coleus, Codiæum or Narcissus are omitted for obvious reasons.

In every case the plant is cited under its published name, although some of the names are doubtfully correct. Where, however, a correction has appeared desirable this is made.

The name of the person in whose collection the plant was first noticed or described is given where known.

An asterisk is prefixed to all those plants of which examples are in cultivation at Kew.

The publications from which this list is compiled, with the abbreviation used to indicate them, are as follows:— *B. M.*— Botanical Magazine. *B. T. O.*—Bulletino della R. Società Toscana di Orticultura. *Bull Cat.* — Bull, Catalogue of New, Beautiful, and Rare Plants. *Gard.*—The Garden. *G. C.* — Gardeners' Chronicle. *G. and F.*—

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Garden and Forest. *Gfl.*—Gartenflora. *G. M.*—Gardeners' Magazine. *Ill. H.* — L'Illustration Horticole. *Jard.*—Le Jardin. *J. of H.*—Journal of Horticulture. *J. O.*—Journal des Orchidées. *K. B.*—Bulletin of Miscellaneous Information, Royal Gardens, Kew. *L.*—Lindenia. *M. G. Z.*—Möller's Deutsche Gärtner-Zeitung. *O.*—L'Orchidophile. *O. R.*—Orchid Review. *R. H.*—Revue Horticole. *R. H. B.* — Revue de l'Horticulture Belge. *Veitch Cat.* — Veitch & Sons, Catalogue of Plants. *W. G.*—Wiener Illustrirte Garten-Zeitung. *Williams Cat.* — Williams, New and General Plant Catalogue. *W. O. A.*—Warner & Williams, Orchid Album.

The abbreviations in the descriptions of the plants are:— *Ft.*—Foot or Feet. *G.*—Greenhouse.—*H.* Hardy. *H. H.*—Half-hardy. *In.*—Inches. *Per.*—Perennial. *S.*—Stove.

***Acidanthera æquinoctialis,** Baker. (*G. C.* 1893, v. xiv., p. 682; *G. and F.* v. vi., pp. 133, 515.) Irideæ. G. A remarkable species with stems 4 ft. high, and ensiform leaves 20 in. long by 1½ in. wide. Flowers on a loose spike, each with a tube 6 in. long and a limb 3 in. across, white with a crimson eye. This plant was known to Dean Herbert, but it has only lately been introduced from the mountains of Sierra Leone, where only it is a native. (Kew.)

***Adiantum nebulosum,** Hort. (*G. C.* 1893, v. xiii., p. 415.) Filices. S. A seedling form of *A. gracillimum.* (Pynaert, Ghent.)

Aërides platychilum, Rolfe. (*K. B.* 1893, p. 64.) Orchideæ. S. A new species allied to *A. houlletianum.* Leaves 6 in. long, over an inch wide; scape 5 in. long; flowers an inch across, lip flat, spur reflexed, sepals and petals light buff, lip yellow and purple. Habitat not recorded. (Glasnevin.)

***Aganisia lepida,** Lind. & Rchb., f. (*L.* t. 400.) Orchideæ. S. A well marked species first introduced in 1865, when it was described and figured by Reichenbach in his *Xenia Orchidacea.* It has erect grassy leaves and tall many-flowered spikes of pure white handsome flowers, each 1½ in. across. Brazil. (L'Horticulture Internationale.)

***Agave angustissima,** Engelm. (*G. and F.* 1893, v. vi., p. 5, fig. 1.) Amaryllideæ. G. A species belonging to the subgenus Littæa and allied to *A. filifera.* Leaves 12 in. to 20 in. long, ⅓ in. broad, flat on both sides, margins filiferous, apex pungent; peduncle 12 ft. high, flowers in pairs, each 1½ in. long, very narrow, yellow, stamens purple. Mexico. (Washington, Dept. of Agric.)

Agave Terraccianoi, Pax. (*Gfl.* 1893, p. 66, fig. 14.) G. Acaulescent, rosette of numerous narrow lanceolate leaves, about 1 ft. long and 2 in. broad, deep green specked with blood red, without a continuous horny border. Inflorescence about 5 ft. high, flowers sessile, greenish-yellow in pairs or singly in the axils of bracts. Native country uncertain, probably Mexico or Texas. (Berlin.)

***Aglaonema rotunda,** N. E. Br. (*G. C.* 1893, v. xiv., p. 86. *J. of H.*, v. xxvii., p. 379, fig. 56.) Aroideæ. S. A new species, with short stems, roundish ovate leaves, 5 in. long, dark green, tinged with pink above, purple beneath. Spathe 2½ in. long, hooded, green. Malaya? (J. Veitch & Sons.)

Aglaonema versicolor, Hort. (*G. C.* 1893, v. xiii., p. 414.) Aroideæ. S. An ornamental leaved plant, the ovate blades being coloured two shades of green and white in patches. E. Indies. (W. Bull.) Until this plant flowers its genus is uncertain.

***Allium cabulicum,** Baker. (*B. M.* t. 7294; *G. C.* 1893, v. xiii., p. 546.) Liliaceæ. H. Flowers in a dense, globose, many-flowered umbel; segments lanceolate, acute, whitish, with a keel of red-brown. A native of Kabul. (Kew.)

***Allomorphia Griffithii,** Hook, f. (*B. M.* t. 7324.) Melastomaceæ. S. A dwarf plant with large orbicular cordate leathery leaves, reddish beneath, bronze-green above, and axillary erect red scapes 8 in. long, bearing numerous small white flowers. Malayan Peninsula. (Kew.)

Alocasia coriacea, Lind. (*G. C.* 1893, v. xiii., p. 475.) Aroideæ. S. "Leaves dark green, with clear green ribs, the petioles rose-coloured when young, then rosy-white, marbled with green." Habitat not recorded. (L'Horticulture Internationale.)

***Alocasia watsoniana,** Hort. (*G. C.* 1893, v. xiii., pp. 442, 569, fig. 83.) Aroideæ. S. A near ally of *A. Putzeysii.* It has large cordately lobed leaf-blades, with wavy margins, and coloured olive green and dark purple on the upper surface, dark purple beneath. Sumatra. (F. Sander & Co.)

***Aloe imbricata,** Hort. (*W. G.* 1893, p. 194.) Liliaceæ. G. A garden hybrid, parentage not stated. (Deleuil, Marseilles.)

***Aloe simoniana,** Hort. (*W. G.* 1893, p. 194.) G. A garden hybrid between *Gasteria disticha* and *Aloe longiaristata.* (Deleuil, Marseilles.)

***Alsophila atrovirens,** Presl. (*G. and F.* 1893, v. vi., p. 194.) Filices. S. An elegant little tree fern with a stem 2 in. in diameter, and a spreading head of broad tripinnate fronds, the pinnæ large dark green, crisp and wavy. Brazil. (Kew, and F. Sander & Co.)

***Amorphophallus oncophyllus,** Prain. (*B. M.* t. 7327.) Aroideæ. S. A new species with a tuberous root-stock 10 in. in diameter, and leaf stalk 3 ft. high by 1 in. in diameter, green with pale green blotches; blade 3½ ft. across, divided into numerous lanceolate pinnæ. Peduncle half as long as the leaves, spathe nearly a foot long, bell-shaped at the base, and coloured inside deep brown purple with yellow blotches; spadix erect, smooth cream yellow. Odour very disagreeable. Andaman Islands. (Kew.)

Androsace sempervivoides, Jacq. (*Gard.* 1893, v. 44, p. 466.) Primulaceæ. H. A remarkable species, coming near *A. sarmentosa,* but having the leaves curled up to resemble a cone. Fl. bright purple. May, June. Western Thibet. (Correvon, Geneva.)

***Angræcum bistortum,** Rolfe. (*K. B.* 1893, p. 65.) Orchideæ. S. A new species allied to *A. arcuatum,* but with much smaller flowers, which are peculiar in having a loop-curved spur. W. Trop. Africa. (Kew.)

Ansellia nilotica, N.E. Br. var. **rossiana,** Rolfe. (*O. R.* vi., p. 199.) Orchideæ. S. A variety with paler-coloured flowers than the type. (H. J. Ross, Florence.)

***Anthurium andréanum,** Lind., var. **amœnum,** Hort. (*G. C.* 1893, v. xiii., p. 415.) Aroideæ. S. A seedling variety with a rose-carmine spathe and a white spadix tipped with yellow. (Pynaert, Ghent.)

***Anthurium andréanum,** Lind., var. **atrosanguineum,** Hort. (*G. C.* 1893, v. xiii., p. 415.) S. A seedling variety, with dark crimson spathes. (Pynaert. Ghent.)

Anthurium crystallinum, Lind. & André, var. **variegatum,** Hort. (*G. C.* 1893, v. xiii., p. 641.) S. A variety with large blotches of creamy white on the leaves. (Pitcher & Manda.)

Anthurium gandavense, Hort. (*G. C.* 1893, v. xiii., p. 415.) S. A garden hybrid between *A. andréanum* and *A. Chantrieri.* (Pynaert, Ghent.)

Anthurium Goldringi, Hort. (*G. and F.* 1893, v. vi., p. 269.) A garden hybrid between *A. andréanum* and *A. scherzerianum.* (Greaves, New Jersey.)

Anthurium Hollandi, Hort. (*G. and F.* 1893, v. vi., p. 269.) S. A garden hybrid between *A. grande* and *A. ferrierense.* (Greaves, New Jersey.)

Anthurium Kellermanni, Hort. (*Jard.* 1893, p. 43, fig. 15.) G. Leaves light green, large, sagittate, with a broad open rounded sinus; auricles broad, very obtuse; a few large teeth on the margins. Spathe small, shorter than the spadix, fls. small, greenish. Origin unknown.

Anthurium scherzerianum, Schott, var. **roseum,** Hort. (*Bull Cat.* 1893, p. 9.) A variety with salmon-rose-coloured spathes. (W. Bull.)

Anthurium scherzerianum, Schott, var. **sanguineum** (*Bull Cat.* 1893, p. 9.) A variety with dark crimson coloured spathes. (W. Bull.)

***Arisæma Giraldii,** Baroni (*B. T. O.* 1893, t. 12). This is *A. consanguineum,* Schott., an old plant allied to *A. erubescens.* China.

***Arundo madagascariensis,** Kunth. (*K. B.* 1893, p. 341.) Gramineæ. S. A tall reed of wide distribution in Asia and Africa as well as Madagascar. It grows from 10 ft. to 20 ft. high and bears feathery panicles similar to Pampas grass. (Recently presented to Kew by Lord de Saumarez.)

Asplenium duale, Jenman. (*G. C.* 1893, v. xiii., p. 10.) Filices. S. A new species resembling *A. falcatum* with woody rootstock, pinnate fronds, 15 in. high, pinnæ an inch broad, serrated, with linear sori in two rows. Inadvertently described as Adiantum. (See *G. C.* ibid., p. 40.) Jamaica. (Demerara B. G.).

***Asplenium marginatum,** Linn. (*G. C.* 1893, v. xiii., p. 641.) Filices. S. A large pinnate leaved species, the fronds ultimately becoming 8 ft. long by 3 ft. in width, the pinnæ strap-shaped and of a rich emerald green colour. (Kew and H. B. May.)

Azalea hybrida Daviesii, Hort. (*Gfl.* 1893, p. 65, tab. 1387.) Ericaceæ. H. A garden hybrid with white fls., supposed to have originated by crossing *A. sinensis* with *A. viscosa*. (Lorberg, Germany.)

Azalea rustica, Hort. flore pleno. (R. H. 1893, p. 195.) H. A garden race said to be derived from *A. mollis* and *A. occidentalis*.

***Azaleodendron,** Rodigas. (*G. C.* 1893, v. xiii., p. 665). H. A so-called bigeneric hybrid between *Azalea mollis* and *Rhododendron John Waterer* and others. Six varieties have been named. They come properly under Rhododendron. (Pynaert, Ghent.)

***Bauhinia variegata,** Linn., var. **candida,** Ham. (*B. M.* t. 7312; *J. of H.* 1893, v. xxvi., p. 277, fig. 54.) Leguminosæ. S. A handsome shrub 5 ft. high with bright green leaves and large pure white fragrant fls. The type is figured in *B. M.* t. 6818. Trop. Asia. (Kew.)

Begonia coronata, Hort. (*Lemoine, Cat.* 1893.) Begoniaceæ. S. A garden hybrid between *B. caroliniæfolia* and *B. polyantha*. (V. Lemoine & Son, Nancy.)

Begonia Excelsior. (*Lemoine, Cat.* 1893, No. 123.) S. A garden hybrid between *B. Baumanni* and *B. Veitchii*. (V. Lemoine & Son, Nancy.)

***Begonia fulgens,** Hort. (*Lemoine Cat.* 1893, No. 123.) G. A new species with a tuberous rootstock, roundish-oblique green leaves and numerous racemes of rich red flowers which are fragrant. It is closely related to *B. Davisi*. Bolivia. (V. Lemoine & Son, Nancy.)

Begonia Lansbergeæ, Linden and Rodigas. (*Ill. H.* 1893, p. 41, t. 174.) S. A species with large hairy emerald-green leaves. Brazil. (L'Horticulture Internationale.)

Begonia martiana, Link and Otto, var. **pulcherrima,** Lem. (*Lemoine, Cat.* 1893, No. 123.) G. A variety with small purple tinged leaves and large carmine-red flowers. (V. Lemoine & Son, Nancy.)

Bignonia rodigasiana, Lind. (*Ill. H.* 1893, t. 183.) Bignoniaceæ. Foliage with bright green ground colour variegated with white, tinted with rosy red when young. (L'Horticulture Internationale.)

***Bletia godseffiana,** Kränzlin. (*G. C.* 1893, v. xiii., p. 442.) Orchideæ. S. Apparently only a variety of *B. verecunda*, R. Br., differing only in having smaller flowers. ? Brazil. (F. Sander & Co.)

Brassia bicolor, Rolfe. (L., t. 378.) Orchideæ. G. A new species nearly allied to *B. Wageneri*. It has large yellow and purple fls., the sepals being 2½ in. long, the petals 2 in. long, the lip patent and acuminate. Peru. (L'Horticulture Internationale.)

Brassia Lewisii, Rolfe. (*O. R.* v. i., p. 199.) G. A new species near *B. lanceana*. It has oblong pseudobulbs, linear oblong leaves 6 in. long and a raceme about 9 in. long bearing 10-12 fls. greenish yellow spotted with brown, lip pale yellow with white keels and orange marks. Habitat not recorded. (W. L. Lewis & Co.)

***Brownleea cœrulea,** Harv. (*B. M.* t. 7309.) Orchideæ. G. A terrestrial species, with a flat lobed tuber, erect annual stems each bearing two or three ovate green leaves and an erect spike of pale blue flowers with violet dots and a long straight spur. S. Africa. (Kew.)

Brugmansia aurea, Lagerh. (*Gfl.* 1893, p. 3.) Solanaceæ. G. In habit and foliage characters this does not differ from *Datura* (*Brugmansia*) *arborea*, but the fls. are golden yellow. Chili.

***Bulbophyllum Ericcsoni,** Kränzlin. (*G. C.* 1893, v. xiv., p. 522.) Orchideæ. S. A new species "by far the most striking new orchid received for a long time past." It has a long creeping rhizome, thin erect pseudobulbs 5 in. high and Stanhopea-like leaves. The fls. are umbellate and each one is 9 in. across, including the tails; they are yellowish-white with brown spots. Habitat not recorded. (F. Sander & Co.)

***Bulbophyllum Hamelini,** Hort. (*G. and F.* 1893, v. vi., p. 336.) S. A remarkable and distinct looking plant with large flat shell-like pseudobulbs 4 ins. in diameter, pressed against the thick rhizome, large leaves and scapes 18 in. long showing numerous flower scars. Fls. not seen. Madagascar. (F. Sander & Co.)

Bulbophyllum racemosum, Rolfe. (*K. B.* 1893, p. 61.) S. A new species allied to *B. anceps*. It has suborbicular pseudobulbs an in. long, each bearing a leathery linear oblong leaf 4½ in. log; scape 6 in. long, fls. ¾ in. long yellowsh spotted with maroon, the lip purple wth black dots near the tip. Borneo. (Sir T. Lawrence.)

***Bulbophyllum sanderianum,** Rolfe. (*K. B.* 1893, p. 4.) S. A new species allied to *B. meridense.* It has short four-angled, monophyllous pseudobulbs and long racemes of green brown spotted fls., the lip hairy and purple-brown. Pernambuco. (F. Sander & Co.)

Bulbophyllum spathaceum, Rolfe. (*K. B.* 1893, p. 170.) S. A new species allied to *B. apodum,* but with shorter leaves and a denser raceme; fls. small light straw-yellow, the lip brighter. Burma. (J. O'Brien.)

***Bulbophyllum viride,** Rolfe. (*K. B.* 1893, p. 170.) S. A new species, allied to *B. intertextum,* with small pseudobulbs and leaves; scape 3 in. long; flowers small, green, with two purple eye-like spots at the base of the lip. W. Trop. Africa. (Kew.)

***Bulbophyllum vitiense,** Rolfe. (*K. B.* 1893, p. 4.) S. A new species with a creeping rhizome, small 4-angled monophyllous pseudobulbs, and racemes 6 in. long, clothed with small whitish and pink flowers. Fiji. (Kew.)

***Caladium rubescens,** N. E. Br. (*G. C.* 1893, v. xiv., p. 86.) Aroideæ. S. A new species with a leaf-blade 6 in. by 2 in., ovate lanceolate, wavy, with short basal lobes, crimson, margined with green. Spathe 3½ in. long, green with a blackish stripe. Brazil. (F. Sander & Co.)

***Caladium venosum,** N. E. Br. (*G. C.* 1893, v. xiv., p. 87.) S. A new species with leaf-blade 10 in. long, 4 in. broad, coloured green, with yellowish nerves and a red margin. Spathe 3 in. long, green. Brazil. (F. Sander & Co.)

Calamus gracillimus, Lind. (*G. C.* 1893, v. xiii., p. 475.) Palmæ. S. "Foliage very narrow, linear, elongated, spaced at wide distances apart." Habitat not recorded. (L'Horticulture Internationale.)

Calamus robustus, Lind. et Rod. (*Ill. H.* 1893, tab. 169.) S. A fine palm with broadly amplexicaul spiny leaf-stalks with brownish-black membranous margins; spines yellowish-green disposed in rings of six or eight. Pinnæ ensiform, crowded. Borneo. (L'Horticulture Internationale.)

Calanthe burfordiense, Hort. (*R.* t. 63.) Orchideæ. S. A garden hybrid, supposed to be between *C. Veitchii* and *C. vestita rubro-oculata.* (F. Sander & Co.)

Calanthe gigas, Hort. (*G. C.* 1893, v. xiii., p. 80; *J. of H.*, v. xxvi., p. 129, fig. 24.) S. A garden hybrid between *C. sanderiana* var. *gigantea* and *C. vestita* var. *gigantea.* (J. Veitch & Sons.)

Calanthe Mylesii. (*G. C.* 1893, v. xiv., p. 692.) S. A garden hybrid or seedling, like a pure white *C. Veitchii.* (B. S. Williams & Son.)

Calanthe vestita, Wall. var. **oweniana,** Williams. (*O. A.* t. 464.) A garden cross between *C. vestita* and *C. Veitchii.*

Calanthe Victoria-Regina. (*R.* t. 63.) S. A garden hybrid supposed to be between *C. Veitchii* and *C. rosea.* (F. Sander & Co.)

***Calceolaria andina,** Benth. (*B. M.* t. 7326; *G. C.* 1893, v. xiv., p. 594.) Scrophularineæ. H. H. An under-shrub, with broadly-stalked, oblong, ovate, rugose leaves, and terminal panicles of yellow flowers. Chilian Andes. (Kew.)

Catasetum imschootianum, L., Lind. (*J. O.* 1893, p. 266; *L.* t. 403.) Orchideæ. S. A new species closely allied to *C. Hookeri.* It has oblong fusiform pseudobulbs, large plicate leaves, and an erect raceme of numerous yellow flowers, the sepals and petals being tinged with green; the labellum is saccate, fleshy, nearly truncate, and folded inwards. Brazil. (L'Horticulture Internationale.)

Cattleya Aclandiæ, Lindl., var. **salmonea,** Hort. (*L.*, t. 399.) Orchideæ. S. A variety with the ground colour of the flowers tinted salmon red. (L'Horticulture Internationale.)

Cattleya Alexandræ, Lind. & Rolfe, var. **elegans,** Rolfe. (*L.*, t. 358.) S. A variety with larger flowers than the type, coloured rose purple. (L'Horticulture Internationale.)

Cattleya Alexandræ, Lind. & Rolfe, var. **tenebrosa,** Rolfe. (*L.* t. 357.) S. A variety with flowers of a deep dusky brown colour and a rose-purple lip. (L'Horticulture Internationale.)

Cattleya amethystoglossa, Lind. and Rchb. f., var. **rosea,** Rolfe. (*L.* t. 375.) S. A rose-tinted variety of *C. guttata* var. *Prinzii.* (L'Horticulture Internationale.)

Cattleya ashtoniana (*G. C.* 1893, v. xiv., p. 406.) S. A garden hybrid between *C. Harrisoniæ* and *C. gigas.* (W. L. Lewis & Co.)

Cattleya Brownii, Rolfe. (*G. & F.* 1893, v. vi., p. 515.) S. A new species with pseudobulbs 2 ft. high, each bearing a pair of large oblong coriaceous leaves and a raceme of five or more flowers each 4 in. in diameter; the sepals and petals are bright rose-purple and undulated; the lip is three-lobed and pale purple with veins of a darker shade. Habitat not recorded. (F. Sander & Co.)

Cattleya Chloris. (*G. C.* 1893, v. xiv., p. 470.) S. A garden hybrid between *C. bowringiana* and *C. maxima*. (J. Veitch & Sons.)

Cattleya Eldorado, Lind., var. **Treyeranæ,** Hort. (*L.*, t. 402.) S. A variety with large broad sepals and petals coloured rosy-lilac, and a large labellum with a blotch of orange-yellow on the front lobe. (L'Horticulture Internationale.)

Cattleya guttata, Lindl., var. **pernambucensis,** Rodigas. (*Ill. H.* 1893, t. 184.) S. Sepals and petals greenish yellow faintly spotted with red-brown, lip bright red bordered with white. (L'Horticulture Internationale.)

Cattleya intermedia, Grah., var. **picturata,** Rolfe. (*O. R.*, v. i., p. 198.) S. A variety with splashes of rose in the sepals and petals, and the side lobes as well as the front lobe of the lip heavily flaked and striped with amethyst purple. (Messrs. Cappe, Vesinet, Seine-et-Oise.)

Cattleya johnstoniana. (*G. C.* 1893, v. xiv., p. 406.) S. A garden hybrid of the same origin as *C. ashtoniana*, which see.

Cattleya Mossiæ, Hook. var. **Mendeli,** L., Lind. (*L.*, t. 376.) S. A variety intermediate between *C. labiata Mossiæ* and *C. labiata Mendelii*. (L'Horticulture Internationale.)

Cattleya Patrocinii, Hort. (*O. R.* v. i., p. 343.) S. A supposed natural hybrid between *C. Loddigesii* and *C. guttata leopardina*. It has the habit of *C. Loddigesii* with rose-purple flowers and a three lobed yellowish lip, the front lobe being deep rose-purple. Brazil. (A. A. Peeters, Brussels.)

Cattleya Pheidona. (*G. C.* 1893, v. xiv., p. 470; *O. R.* v. i., p. 363.) S. A garden hybrid between *C. intermedia* and *C. maxima*. (J. Veitch & Sons.)

Cattleya Trianæ, Lind. & Rchb. f., var. **broomeana,** O'Brien. (*G. C.* 1893, v. xiii., p. 290.) S. A variety with broad nearly white segments and a blotch of glowing crimson on the labellum. (J. Broome.)

Cattleya Trianæ, Lind. & Rchb. f., var. **Gravesiæ,** R. M. Grey. (*G. C.* 1893, v. xiii., p. 357.) S. A variety with narrow leaves and pseudobulbs and large flowers with a red blotch on the labellum. (H. Graves, New Jersey.)

Cattleya Warneri, Moore, var. **formosa,** Hort. (*G. C.* 1893, v. xiii., p. 641.) S. A variety with large richly coloured flowers. (Charlesworth, Shuttleworth & Co.)

Cattleya Warscewiczii, Rchb. f. var. **franconvillensis,** O'Brien. (*G. C.* 1893, v. xiv., p. 150.) S. A variety with pure white flowers with a blotch of rich purplish-crimson on the lip. (Duc de Massa, France.)

Cattleya Warscewiczii, Rchb. f., var. **purpurea,** Hort. (*G. C.* 1893, v. xiii., p. 752.) S. A variety with rich deep purplish coloured flowers. (F. Sander & Co.)

Cattleya Warscewiczii, Rchb. f., var. **Sanderæ,** Hort. (*G. C.* 1893, v. xiii., p. 752.) S. "Flowers of a warm crimson colour and with a velvety labellum. (F. Sander & Co.)

Cattleya William Murray. (*G. C.* 1893, v. xiii., p. 639.) S. A garden hybrid between *C. Mendelii* and *C. lawrenciana*. (N. C. Cookson.)

Cattleya wellsiana. (*G. C.* 1893, v. xiii., p. 639.) S. A garden hybrid between *C. superba* and *Lælia elegans?* (F. Sander & Co.)

Ceanothus Fenolleri. Gray. (*Gfl.* 1893, p. 536.) Rhamnaceæ. H. H. A much branched thorny bush from one to two feet high with egg-shaped or elliptic leaves silky below and dark green, glossy, and smooth above. Flowers snow-white. Colorado, &c. (Spath, Berlin.) This name is doubtless a misprint for *C. Fendleri*, Gray.

Centaurea odorata, Koch, var. **alba.** (*B. T. O.* 1893, p. 105, f. 12.) Compositæ. A variety differing from the type in having white flowers. Syn. *C. Margaritæ*, Sprenger. (Dammann & Co., Naples.)

***Cephalandra palmata,** Schrad. (*B. T. O.* 1893, p. 331.) Cucurbitaceæ. S. A perennial cucurbit with a very large bulbous rootstock and ivy-like leaves and small fruits scarlet marbled with white. S. Africa. (Dammann & Co.)

***Chlorophytum brachystachyum,** Baker. (*G. C.* 1893, v. xiii., p. 710.) Liliaceæ. G. A new species allied to *C. stenopetalum*. It has Eucomis-like leaves, 8 in. long and a dense raceme of small white flowers. Nyassaland. (Kew.)

Chysis oweniana, Hort. (*G. C.* 1893, v. xiv., p. 756.) Orchideæ. S. This is *C. bruennowiana*, Rchb. f., which was introduced about forty years ago. It resembles *C. aurea* in habit and bears several medium-sized flowers of a pinkish hue. Peru. (F. Sander & Co.)

***Cineraria maritima,** Linn., var. **aureo-variegata,** Hort. (*G. C.* 1893, v. xiii., p. 641; *J. of H.*, v. xxvi., p. 438, fig. 78.) Compositæ. G. A prettily variegated variety, the leaves green margined with creamy yellow. (H. B. May.)

Cirrhopetalum brienianum, Rolfe. (*K. B.* 1893, p. 62.) Orchideæ. S. A new species allied to *C. makoyanum*, pseudobulbs ovoid ½ in. long; leaves oblong, 2¼ in. long; scape 9 in. long; flowers small, yellow and maroon. Borneo. (L'Horticulture Internationale.)

***Cirrhopetalum robustum,** Rolfe. (*O. R.* v. i., p. 175.) S. A new species with large ovate angled pseudobulbs and thick leathery leaves 13 in. long and 4 in. wide. Scape very stout, bearing an eleven-flowered umbel 7½ in. across; flowers 2¼ in. long; sepals and petals greenish-yellow tinged with purple, lip deep red purple. This is the largest species known. New Guinea. (Col. T. Clarke.)

Cœlogyne borneensis, Rolfe. (*K. B.* 1893, p. 62.) Orchideæ. S. A new species, allied to *C. longifolia*; pseudobulbs ovoid, each bearing two obovate leaves; raceme 5 in. long; flowers small whitish with red brown markings on the lip. Borneo. (L'Horticulture Internationale.)

Cœlogyne Clarkii, Kränzlin. (*G. C.* 1893, v. xiii., p. 741.) S. A new species in the way of *C. anceps*. It has light brown sepals and petals and a yellowish brown lip margined with brown. Habitat not recorded. (F. Sander & Co.)

***Cœlogyne sanderæ,** Kränzlin. (*G. C.* 1893, v. xiii., pp. 336, 360, fig. 52; *R.* t. 56.) S. A new species allied to *C. barbata*. It has ovate pseudobulbs, ovate lanceolate leaves, and erect scapes bearing flowers 2 in. across, white with a yellow blotch on the lip and a fringe of long brown hairs on the keel. Upper Burma. (F. Sander & Co.)

Cœlogyne tenuis, Rolfe. (*K. B.* 1893, p. 171.) S. A new species, near *C. borneensis*, differing in its one-leaved pseudobulbs, slender scapes, and other characters. Flowers small, of a light buff colour. Borneo. (L'Horticulture Internationale.)

Cladrastis tinctoria, Raf., fol. var. (R. H., 1893, p. 391.) Leguminosæ. A form of the yellow wood with variegated leaves, variegation said to be constant. (Simon-Louis Frères, Metz.)

Clematis Pitcheri × coccinea. (*R. H.* 1893, p. 376.) Ranunculaceæ. H. A garden hybrid intermediate in character between the two parents. (Morel, Lyons.)

Clethra arborea, Ait., var. **fol. variegat.** (*R. H. B.* 1893, p. 285, t.) Ericaceæ. G. A form of this handsome Madeiran tree with variegated leaves. (Pynaert, Ghent.)

Cocos odorata, Barb. Rodr. (*R. H.* 1893, p. 345, f. 110.) Palmeæ. G. A dwarf species like *C. campestris*, but differing in its depressed subspherical apiculate fruits. (Countess de Foz.)

Coreopsis aristosa, Michx., var. **mutica,** Purpus (*Gfl.* 1893, p. 449, pl.) Compositæ. H. A showy annual, about 3 ft. high, with cut leaves turning bronzy, and bright deep yellow flower heads. United States. (Darmstadt.)

Coryanthes Wolfii, Lehm. (*O. R.* v. i., p. 264; *G. C.* 1891, v. x., p. 483.) Orchideæ. S. A very remarkable species with stiff upright scapes of yellow and brownish red, medium-sized flowers, remarkable for their nearly flat solid hood. Ecuador. (Glasnevin.)

***Cotyledon Barbeyi,** Baker. (*G. C.* 1893, v. xiii., p. 624.) Crassulaceæ. G. A new species allied to *C. orbicularis*. (*Bot. Mag.* t. 321.) It is perennial, with tall branching stems and fleshy glaucous leaves 3 in. long. Flowers numerous in a sub-globose panicle, corolla 1 in. long, green and red. Arabia Felix. (Dammann & Co., Naples.)

Cotyledon quitensis, Hort. (*W. G.* 1893, p. 144, f. 33.) G. A dwarf branched compact-growing plant, with red flowers borne in racemes from December onwards. (Dammann & Co., Naples.) This plant is altogether different from the true *C. quitensis*, Baker.

Crocus Crewii, Hook. (*Gard.* 1893, v. xliii., p. 278.) Irideæ. H. A distinct species, closely allied to *C. biflorus*, with almost black anthers and a rich orange centre. Asia Minor. (Whittall, Smyrna.)

Crocus luteus, Roch., var. **striatus** (*G. C.* 1893, v. xiii., p 385.) H. A form of the ordinary Dutch crocus, with three distinct black stripes on the back of the outer segments of the perianth. (Col. Trevor Clarke.)

Crocus Tauri, Maw., var. **melanthorus,** Baker. (*G. C.* 1893, v. xiii., p. 226.) H. A form of *C. Tauri* with black anthers. Smyrna. (J. Allen.)

***Crotalaria longirostrata,** Hook. & Arn. (*B. M.* t. 7306.) Leguminosæ. A handsome greenhouse plant, growing to a yard in height, with thin branches, clothed with trifoliate leaves, and bearing in winter erect racemes of rich yellow flowers. Mexico. (Kew.)

Croton Russelli, Hort. (*G. C.* 1893, v. xiv., p. 629; *J. of H.* v. xxvii., p. 493, fig. 71.) Euphorbiaceæ. S. A seedling variety of the popular garden Croton = *Codiæum pictum,* var. (H. Low & Co.).

Croton Thomsoni, Hort. (*G. C.* 1893, v. xiii., p. 641.) S. One of the many seedling varieties of *Codiæum pictum.* (J. Laing and Son.)

***Cucurbita maxima,** Duch., var. **sylvestris,** Naud. (*B. T. O.* 1893, p. 333.) Cucurbitaceæ. Supposed to be the origin of all the large-fruited gourds in cultivation. The native country of *C. maxima* was unknown, but the present plant has been found wild in the Himalayan region; fruit as large as a man's head. (Dammann & Co., Naples.)

Cucurbita mexicana, Sprenger. (*B. T.O.* 1893, p. 334.) H. H. According to Naudin this is *C. melanosperma,* Naud., *var. mexicana.* Seeds twice the size of those of the type. Said to grow wild in the neighbourhood of Mazatlan in Mexico. (Dammann & Co., Naples.)

Cupania elegans, Lind. (*G. C.* 1893, v. xiii., p. 474.) Sapindaceæ. S. "A " species with light and graceful foliage, " leaves undulated and toothed at the " edges." Habitat not recorded. (L'Horticulture Internationale.)

Cyanophyllum aspersum, Lind. (*G. C.* 1893, v. xiii., p. 475.) Melastomaceæ. S. " Leaves more elongated than in *C.* " *magnificum,* and coated with a most " delicate down, which gives it a " beautiful velvety texture." Habitat not recorded. (L'Horticulture Internationale).

Cymbidium grandiflorum, Griff., var. **punctatum,** Cogn. (*L.*, t. 389; *J. O.* 1893, p. 76.) Orchideæ. S. A variety with purplish spots on the lower parts of the segments. (L'Horticulture Internationale.)

Cymbidium lowianum, Rchb. f., var. **aureum,** Hort. (*G. C.* 1893, v. xiii., p. 682.) S. A variety with flowers almost wholly of a yellow colour, with a blotch of orange on the lip.

Cymbidium lowianum, Rchb. f., var **superbissimum,** Lind. (*L.*, t. 392.) S. A variety with the front lobe of the labellum coloured deep maroon purple. (L'Horticulture Internationale.)

***Cynorchis grandiflora,** Ridley. (*G. C.* 1893, v. xiii., pp. 80, 197, fig. 29; *O. R.* v. i., p. 59.) Orchideæ. S. A tuberous rooted terrestrial orchid, with ensiform annual leaves and erect one- or two-flowered scapes a foot long. Flowers 1½ in. across, sepals and petals small greenish with purple spots, lip large, four-lobed with a long spur, and coloured bright rose purple. Madagascar. (Lewis & Co.).

Cyperus aristatus, Hort. (*B. T. O.* 1893, p. 107, f. 14.) Cyperaceæ. G. An annual species hardly six inches high; said to be a pretty decorative plant. Mexico. (Dammann & Co., Naples.)

Cyperus gracilis, Hort. (*R. H.* 1893, p. 391.) G. A form of *C. alternifolius variegatus,* with filiform stems and leaves. (Dutrie Frères, France.)

Cypripedium Æson. (*G. C.* 1893, v. xiii., p. 80.) Orchideæ. S. A garden hybrid between *C. Druryi* and *C. insigne.* (J. Veitch & Sons.)

Cypripedium Alfred Bleu. (*R. H.* 1893, p. 84, col. plate.) Orchideæ. S. A garden hybrid between *C. ciliolare* and *C. insigne Chantini.* (Bleu, Paris.)

Cypripedium Aphrodite. (*G. C.* 1893, v. xiv., p. 342.) S. A garden hybrid between *C. niveum* and *C. lawrencianum.* (J. Veitch & Sons.)

Cypripedium appletonianum, Hort. (*G.* v. xliii., p. 95; *O. R.* v. i., p. 135.) S. " Evidently only a variety of *C. bullenianum,* with paler coloured flowers " and bright green leaves reticulated " with dark green." (W. M. Appleton.)

Cypripedium bellatulum, Rchb. f., var. **luteopurpureum,** O'Brien. (*G. C.* 1893, v. xiv., p. 179.) S. A variety with yellowish flowers blotched with purple. (G. W. L. Schofield.)

Cypripedium Charles Rickman. (*G. C.* 1893, v. xiii., p. 580; *J. of H.* v. xxvi., p. 517, fig. 92.) S. A garden hybrid between *C. barbatum* and *C. bellatulum.* (C. Rickman.)

***Cypripedium Charlesworthii,** Rolfe. (*G. C.* 1893, v. xiv., pp. 406, 437, fig. 70; *O. R.* v. i., p. 303.) S. A new species, closely allied to *C. spicerianum,* which it resembles in leaf and in size and form of flower, differing mainly in colour; the dorsal sepal is white, veined and shaded with rosy purple; petals and lip yellowish tinged with brown; staminode white. (Charlesworth, Shuttleworth, & Co.)

Cypripedium Claudii. (*L.*, t. 397.) S. A garden hybrid between *C. spicerianum* and *C. vernixium.* (M. Moens, Lede.)

Cypripedium Cleola. (*O.* 1893, p. 162.) S. A garden hybrid between *C. Schlimii albiflorum* and *C. boissierianum.*

Cypripedium clinkaberryanum. (*G. C.* 1893 v. xiv., p. 86, fig. 18.) S. A garden hybrid between *C. philippinense* and *C. Curtisii.* (C. G. Roebling, New Jersey.)

Cypripedium Clonius. (*G. C.* 1893, v. xiv., p. 536.) *J. of H.*, v. xxvii., p. 395, fig. 58.) A garden hybrid between *C. conchiferum* and *C. caudatum Wallisii.* (J. Veitch & Sons.)

Cypripedium Clymene. (*G. C.* 1893, v. xiii., p. 456.) S. A garden hybrid between *C. caricinum* and *C. caudatum*, var. *Wallisii.* (J. Veitch & Sons.)

Cypripedium conco-lawre. (*J. of H.* 1893, v. xxvi., p. 193, fig. 41.) S. A garden hybrid between *C. concolor* and *C. lawrencianum.* (Sir T. Lawrence.)

Cypripedium concolor, Parish, var. **striata,** O'Brien. (*G. C.* 1893, v. xiii., p. 596.) S. A variety with narrow segments lined with purple, the lip dotted with purple. Mergui. (R. B. White.)

Cypripedium constableanum. (*G.* v. xliii., p. 75.) S. A garden hybrid between *C. fairieanum* and *C. dayanum.* (F. A. Constable, New York.)

Cypripedium Creon. (*G. C.* 1893, v. xiii., p. 80.) S. A garden hybrid between *C. œnanthum superbum* and *C. harrisianum.* (J. Veitch & Sons.)

Cypripedium Déception. (*O.* 1893, p. 97.) S. A garden hybrid between *C. hirsutissimum* and *C. venustum.* (Godefroy-Lebeuf, Paris.)

Cypripedium Dibdin. (*G. C.* 1893, v. xiii., p. 162.) S. A garden hybrid between *C. Argus* and *C. Boxalli.* (F. G. Tautz.)

Cypripedium Edwardii. (*G. C.* 1893, v. xiv., p. 132.) S. A garden hybrid between *C. fairieanum* and *C. superbiens.* (Pitcher & Manda.)

Cypripedium enfieldense, var. **Hebe.** (*O. R.* v. i., p. 309.) S. A garden hybrid between *C. Hookeræ measuresianum* and *C. lawrencianum.* (R. J. Measures.)

Cypripedium Erato. (*O. R.*, v. i., p. 118.) S. A garden hybrid between *C. Sallieri* and *C. hirsutissimum.* (C. Vuylsteke, Ghent.)

Cypripedium Eucharis. (*G. C.* 1893, v. xiii., p. 195.) S. A garden hybrid between *C. insigne Chantini* and *C. lawrencianum.* (C. Vuylsteke, Ghent.)

Cypripedium eyermanianum, var. **Diana.** (*O. R.* v. i., p. 309.) S. A garden hybrid between *C. barbatum superbum* and *C. spicerianum.* (R. J. Measures.)

Cypripedium fascinatum. (*G. C.* 1893, v. xiv., p. 756.) S. A garden hybrid between *C. spicerianum* and *C. hirsutissimum.* (J. Hye-Leysen, Ghent.)

Cypripedium fairieano-lawrencianum. (*G. M.* 1893, p. 728, fig.) S. A garden hybrid between the two species indicated by the name. (T. Statter.)

Cypripedium Ganesa. (*O. R.* v. i., p. 308.) S. A garden hybrid between *C. lawrenceanum hyeanum* and *C. Sallieri.* (R. J. Measures.)

Cypripedium greyanum. (*G. C.* 1893, v. xiii., p. 396.) S. A garden hybrid between *C. ciliolare* and *C. Druryi.* (Pitcher & Manda.)

Cypripedium Hebe. (*G. and F.* 1893, v. vi., p. 105.) S. A garden hybrid between *C. Stonei* and *C. spicerianum.* (H. Graves, New Jersey.)

Cypripedium Hermione. (*G. C.* 1893, v. xiv., p. 682.) S. A garden hybrid between *C. spicerianum* and *C. barbatum Warneri.* (R. Young.)

Cypripedium hybridum corbeillense (*R. H.* 1893, p. 250.) S. A cross between *C. Bulleni* and *C. insigne.* (Maron, France.)

Cypripedium insigne, Wall., var. **albens.** Hort. (*G. C.* 1893, v. xiv., p. 536.) S. A variety with flowers coloured yellow and white, with scarcely any of the brown markings of the type. (Heath & Son.)

Cypripedium insigne, Wall., var. **Clarkei,** Hort. (*G. C.* 1893, v. xiv., p. 537.) S. A variety with only a few spots on the dorsal sepal. (W. C. Clarke.)

Cypripedium insigne, Wall., var. **Ernestii,** Hort. (*G. C.* 1893, v. xiv., p. 630.) S. A variety with pale-coloured flowers, not unlike that called *Sanderæ.* (R. J. Measures.)

Cypripedium insigne, Wall., var. **illustre,** Hort. (*G. C.* 1893, v. xiv., p. 692.) S. A variety with flowers of a clearer yellow hue than usual. (R. J. Measures.)

Cypripedium leeanum ampliatum, Hort. (*G. and F.* 1893, v. vi., p. 117.) S. A variety with flowers one-third larger than the type. (Pitcher & Manda.)

Cypripedium Ledouxiæ. (*O. R.* v. i., p. 117.) S. A garden hybrid of doubtful origin. It is said to be very near *C. harrisianum*. (G. R. le Doux.)

Cypripedium Leonæ. (*L.* t. 360; *G. C.* 1893, v. xiv., p. 342.) S. A garden hybrid between *C. insigne*, var. *Chantini*, and *C. callosum*. (L'Horticulture Internationale.)

Cypripedium lucienianum. (*L.* t. 362.) S. A garden hybrid between *C. villosum* and *C. œnanthum superbum*, or *C. bellatulum*. (L'Horticulture Internationale.)

Cypripedium lynchianum. (*G. C.* 1893, v. xiv., p. 692.) S. A garden hybrid between *C. spicerianum* and *C. selligerum majus*. (F. Sander & Co.)

Cypripedium macropterum. (*G. C.* 1893, v. xiii., p. 396.) S. A garden hybrid between *C. Lowii* and *C. superbiens*. (Pitcher & Manda.)

Cypripedium Mme. Gibez. (*O.* 1893, p. 67.) A garden hybrid between *C. venustum* and *C. villosum*. (Mdme. Gibez, France.)

Cypripedium massaianum. (*G. C.* 1893, v. xiv., pp. 70, 267, fig. 48.) S. A garden hybrid between *C. superciliare* and *C. rothschildianum*. (F. Sander & Co.)

Cypripedium mauriceanum. (*O. R.* v. i., p. 118.) S. A garden hybrid between *C. harrisianum* and *C. spicerianum*. (O. Block, Paris.)

Cypripedium Melanthus. (*G. C.* 1893, v. xiii., p. 456; *O. R.*, v. i., p. 147.) S. A garden hybrid between *C. Hookeræ* and *C. Stonei*. (J. Veitch & Sons.)

Cypripedium Memoria Mœnsii. (*L.* t. 361.) S. A garden hybrid, the parentage of which is unrecorded, but it is probably between *C. spicerianum* and *C. hirsutissimum*. (J. Moens, Lede.)

Cypripedium Minos. (*G. C.* 1893, v. xiv., p. 692.) S. A garden hybrid between *C. spicerianum* and *C. arthurianum*. (J. Veitch & Sons.)

Cypripedium Mulus. (*O. R.* v. i. p. 244.) S. A garden hybrid between *C. hirsutissimum* and *C. lawrencianum*.

Cypripedium Murillo. (*G. C.* 1893, v. xiii., p. 162.) S. A garden hybrid between *C. Boxalli*, var. *atratum* and *C. Argus*. (C. Vuylsteke, Ghent.)

Cypripedium œno-superbiens. (*J. of H.* 1893, v. xxvii., p. 269, fig. 38.) S. A garden hybrid between *C. œnanthum* and *C. superbiens*. (Sir T. Lawrence.)

Cypripedium Orion. (*G. C.* 1893, v. xiii., p. 80.) S. A garden hybrid between *C. concolor* and *C. insigne*. (J. Veitch & Sons.)

Cypripedium Paris. (*O. R.* vi., p. 87, fig. 6.) S. A garden hybrid between *C. bellatulum* and probably *C. Stonei*. (R. H. Measures.)

Cypripedium Paulii. (*O. R.* v., i., p. 147.) S. A garden hybrid between *C. harrisianum* and *C. selligerum*. (J. C. Bowring.)

Cypripedium Penelaus. (*G. C.* 1893, v. xiii., p. 80; *J. of H.* v. xxvi., p. 219, fig. 45.) S. A garden hybrid between *C. caudatum*, var. *Lindeni* and *C. calurum*. (J. Veitch & Sons.)

Cypripedium Phædra. *See* under *Selenipedium*.

Cypripedium pryorianum. (*G. C.* 1893, v. xiv., p. 692.) S. A garden hybrid between *C. lathamianum* and *C. harrisianum*. (F. Sander & Co.)

Cypripedium Sallieri pictum. (*G. and F.* 1893, v., vi., p. 117). S. A garden hybrid between *C. villosum superbum* and *C. insigne Chantini*. (Pitcher & Manda.)

Cypripedium Sandero-superbiens. (*G. C.* 1893, v. xiv., p. 278; *J. of H.* v. xxvii., p. 215, fig. 31). S. A garden hybrid between the two species indicated by the name. (N. C. Cookson.)

Cypripedium sibyrolense. (*I. H.* 1893, p. 69, t. 179.) S. A garden hybrid between *C. Boxalli* and *C. insigne*. (L'Horticulture Internationale).

Cypripedium southgatense superbum. (*G. C.* 1893, v. xiv., p. 630). S. A garden hybrid between *C. bellatulum* and *C. harrisianum*. (T. Statter).

Cypripedium spicerianum, Rchb. f., var. **mercatellianum,** Pucci. (*B. T. O.* 1893, p. 144, pl.) A variety with more white in the flower than in that of the type. (Mercatelli, Florence.)

Cypripedium statterianum. (*G. C.* 1893, v. xiv., p. 536; *J. of H.* v. xxvii., p. 417, fig. 61.) A garden hybrid between *C. spicerianum* and *C. vexillarium.* (T. Statter.)

Cypripedium Sylvia. (*G. C.* 1893, v. xiii., p. 682.) S. A garden hybrid between *C. Curtisii* and *C. lawrencianum.* (C. Winn.)

Cypripedium Tacita. (*G. C.* 1893, v. xiii., p. 357.) S. A garden hybrid between *C. measuresianum* and *C. tonsum.* (H. Graves, New Jersey.)

Cypripedium Tennyson. (*G. C.* 1893, v. xiv., p. 490.) S. A garden hybrid between *C. œnanthum superbum* and *C. dayanum.* (P. McArthur.)

Cypripedium tonso-villosum. (*G. and F.* 1893, v. vi, p. 117.) S. A garden hybrid between the two species indicated in the name. (Pitcher & Manda.)

Cypripedium Turpe. (*O.* 1893, p. 169.) A garden hybrid between *C. barbatum,* var. *Crossii* and *C. Argus.* (Godefroy-Lebeuf, Paris.)

Cypripedium T. W. Bond. (*G. C.* 1893, v. xiii., p. 396.) A garden hybrid between *C. swanianum* and *C. hirsutissimum.* (C. L. N. Ingram.)

Cypripedium thayerianum. (*G. C.* 1893, v. xiv., p. 193.) S. A garden hybrid between *C. lawrencianum* and *C. Boxalli.* (F. Sander & Co.)

Cypripedium tryonianum. (*G. C.* 1893, v. xiv., p. 134.) S. A garden hybrid between *C. harrisianum* and *C. superbiens.* (H. Tate.)

Cypripedium umlauftianum. (*G. C.* 1893, v. xiv., p. 70.) S. A garden hybrid between *C. insigne,* var. *Chantini* and *C. lawrencianum.* (F. Sander & Co.)

Cypripedium venustum, Wall., var. **measuresianum,** Hort. (*G. C.* 1893, v. xiv., p. 756.) S. A variety with flowers in which the only colours are white and green. (R. J. Measures.)

Cypripedium vernixium punctatum. (*G. and F.* 1893, v. vi., p. 117.) S. A variety with a recurved dorsal sepal and slight colour differences. (Pitcher & Manda.)

Cypripedium vexill-Io. (*G. C.* 1893, v. xiii., p. 752.) S. A garden hybrid between *C. vexillarium* and *C. Io.* (N. C. Cookson.)

Cypripedium villosum, Lindl., var. **Gortoni,** O'Brien. (*G. C.* 1893, xiii. p. 40.) S. A variety differing from the type chiefly in the purplish colour of its flowers. Burma. (Dr. Gorton.)

Cypripedium villosum, Lindl., var. **measuresianum.** O'Brien. (*G. C.* 1893, v. xiv., p. 297.) S. A variety with large dark blotches as in *C. Boxalli* var. *atratum.* (F. Sander & Co.)

Cypripedium Vipani, var. **roseum,** Hort. (*O. R.*, v. i., p. 245.) S. A garden hybrid between *C. niveum* and *C. philippinense* var. (C. Ingram.)

Cypripedium villosum, Lindl., var. **violaceum,** Desbois. (*G. C.* 1893, v. xiii., p. 195.) S. A garden hybrid between *C. villosum* and *C. hirsutissimum.* (Ch. Vuylsteke, Ghent.)

Cypripedium volonteanum giganteum. Hort. (*G. C.* 1893, v. xiii., p. 641.) S. A variety with flowers twice as large as the type. (H. Low & Co.)

Cypripedium watsonianum. (*O. R.* v. i., p. 244.) S. A garden hybrid between *C. harrisianum nigrum* and *C. concolor.* (F. Sander & Co.)

Cypripedium weathersianum. (*L.* t. 397.) S. A garden hybrid between *C. leeanum superbum* and *C. hirsutissimum.* (L'Horticulture Internationale.)

Cypripedium winnianum. (*G. C.* 1893, v. xiii., p. 207.) S. A garden hybrid between *C. villosum* and *C. Drurii.* (J. Veitch & Sons.)

Cypripedium Zampa. (*O. R.* v. i., p. 118.) S. A garden hybrid between *C. leeanum superbum* and *C. hirsutissimum.* (C. Vuylsteke, Ghent.)

Cyrtanthus intermedia. (*G. C.* 1893, v. xiii., p. 413.) Amaryllideæ. S. A garden hybrid between *C. Mackenii* and *C. angustifolius.* (W. Bull.)

Cyrtopera papillosa, Rolfe. (*K. B.* 1893, p. 336.) Orchideæ. S. A new species, allied to *C. foliosa,* Lindl. Leaves lanceolate 12 in. long; scape 2 ft. high, bearing a few flowers each about an inch across and coloured yellow with purplish brown on the side lobes of the lip. Natal. (J. O'Brien.)

Cyrtopodium Aliciæ, Linden & Rolfe. (*L.* t. 371.) Orchideæ. S. A new species allied to *C. cristatum,* Lindl. It has large fusiform pseudobulbs, long linear lanceolate leaves, and a tall branched scape bearing numerous flowers which are 1½ in. across, green with brown spots, and a three-lobed labellum coloured white with crimsno spots. Brazil. (L'Horticulture Internationale.)

Davallia fijiensis, Hook., var. **elegans,** Hort. (*G. C.* 1893, v. xiii., p. 641.) Filices. S. A variety with finely divided fronds. (W. & J. Birkenhead.)

Dendrobium Benita. (*G. C.* 1893, v. xiii., p. 355.) Orchideæ. S. A garden hybrid between *D. aureum,* and *D. Falconeri.* (W. E. Brymer.)

Dendrobium Bensoniæ, Rchb. f., var. **album,** Hort. (*G. C.* 1893, v. xiii., p. 580.) S. A variety with longer segments and less colour in the flowers than the type. (T. Statter.)

Dendrobium Bryan. (*G. C.* 1893, v. xiii., p. 395.) S. A garden hybrid between *D. luteolum* and *D. wardianum.* (N. C. Cookson.)

Dendrobium cheltenhamense. (*G.* v. xliii., p. 389.) S. A garden hybrid between *D. luteolum* and *D. aureum* (J. Cypher.)

Dendrobium Mentor. (*G. C.* 1893, v. xiii., p. 580.) S. A garden hybrid between *D. superbum* and *D. primulinum.* (J. Veitch & Sons.)

Dendrobium Niobe. (*G. C.* 1893, v. xiii., p. 456; *O. R.* v. i., p. 146.) S. A garden hybrid between *D. tortile* and *D. nobile.* (J. Veitch & Sons.)

Dendrobium nobile, Lindl., var. **Amesiæ,** Hort. (*O. R.* v. i., p. 115.) S. A variety with pure white sepals and petals and a large richly coloured lip. (F. Sander & Co.)

Dendrobium nobile, Lindl., var. **ballianum,** Hort. (*G. C.* 1893, v. xiii, p. 322; *O. R.* v. i., p. 115.) S. A variety with white segments, tipped with pale pink instead of purple. (F. Sander & Co.)

***Dendrobium owenianum.** (*G. C.* 1893, v. xiii., pp. 206, 226; *O. R.*, v. i., p. 86.) S. A garden hybrid between *D. linawianum* and *D. wardianum.* These are the parents of *D. chlorostele,* Rchb. f. (F. Sander and Co.)

Dendrobium rœblingianum. (*O. R.* v. i., p. 211.) S. A garden hybrid between *D. Ruckeri* and *D. nobile.* (Pitcher & Manda, New Jersey.)

Dendrobium Rubens. (*G. C.* 1893, v. xiii., p. 226.) S. A garden hybrid between *D. leechianum* and *D. nobile nobilius.* (J. Cypher.)

Dendrobium Sibyl. (*G. C.* 1893, v. xiii., p. 395.) S. A garden hybrid between *D. linawianum* and *D. bigibbum.* (N. C. Cookson.)

***Dermatobotrys Saundersii,** Bolus. (*K. B.* 1893, p. 367.) Scrophularineæ. S. A deciduous perennial, with somewhat herbaceous stems a foot high and fleshy oblong ovate leaves; the flowers are produced in whorls below the new leaves, each flower being tubular 1½ in. long, and coloured bright red and yellow. Zululand. (Kew.)

Desmodium penduliflorum, Oudem., var. **fl. albo.** (*W. G.* 1893, p. 69.). Leguminoseæ. H. A white flowered form. (Treyve, France.)

Deutzia parviflora, Bunge. (*G. C.* 1893, v. xi., p. 152, f. 31.) Saxifrageæ. A white-flowered bush, hardy in Britain. China.

Dianthus hybridus, Gartenbau-Direcktor R. Brandt. (*Gfl.* 1893, t. 1389.) Caryophyllaceæ. H. A new garden race supposed to have originated between *D. barbatus* and *D. sinensis.* (Amelung, Berlin.)

Dipladenia eximea, Hemsley. (*G. C* 1893, v. xiv., p. 120.) Apocynaceæ. S. A new species with elliptical or orbicular leaves nearly 2 in. long, and cymose racemes of rich rose red flowers, each 2½ in. across. ? Brazil. (F. Sander & Co.)

***Disa kewensis.** (*G. C.* 1893, v. xiii., p. 625; *G. & F.*, vi., p. 244.) Orchideæ. G. A garden hybrid between *D. grandiflora* and *D. tripetaloides.* (Kew.)

***Disa Premier.** (*G. C.* 1893, v. xiv., p. 470; *G. M.*, 1893, p. 658, fig.) G. A garden hybrid between *D. Veitchii* and *D. tripetaloides.* (Kew.)

***Dizygotheca leptophylla,** Hemsl. (*K. B.* 1893, p. 156.) Araliaceæ. S. This is the correct name of the plant which has been in cultivation for over 30 years under the name of *Aralia leptophylla.* Habitat unknown, but likely to be Polynesia.

***Dolichos simplicifolius,** Hook. f. (*B. M.* t. 7318.) Leguminosæ. S. A new species, remarkable in having a woody tuberous rhizome or caudex, which gives off annual herbaceous erect stems about a foot long, bearing simple lanceolate leaves 6 in. long, and axillary clusters of pink pea-shaped flowers. Trop. Africa. (Kew.)

***Dorstenia Walleri,** Hemsl. (*G. C.* 1893, v. xiv., p. 178.) Urticaceæ. S. A new species near *D. Mannii,* with a tuberous rootstock, perennial stems a foot high, and ovate fleshy leaves 2 in. to 5 in. long; inflorescence green, star-shaped, nearly an inch across with five tails 2 in. long. Nyassaland. (Kew.)

***Doryanthes Guilfoylei,** Hort. (*Gard.* 1893, v. xliv., p. 69, fig.) Amaryllideæ. S. According to Mr. Baker this is only a form of *D. Palmeri.* It has leaves 9 ft. long and 8 in. wide and a flower spike 16 ft. high, bearing numerous clusters of crimson amaryllis-like flowers. Queensland. (Botanic Gardens, Melbourne.)

Dracæna cuprea, Lind. et Rodigas. Liliaceæ. S. A Cordyline, probably a form of *C. terminalis* with coppery-brown leaves shaded with green, leaf stalks salmon-rose. (L'Horticulture Internationale.)

***Dracæna godseffiana,** Hort. (*G. & F.* 1893, v. vi., p. 194.) S. A prettily variegated plant, with the characters of *D. surculosa,* but the spots on the leaves are bright creamy yellow. West Trop. Africa. (F. Sander & Co.)

Dracæna Jamesii, Hort. (*G. C.* 1893, v. xiv., p. 629.) S. A seedling variety of *Cordyline terminalis.* (J. Veitch & Sons.)

***Dracæna sanderiana,** Hort. (*G. C.* 1893, v. xiii., p. 442, fig. 65, also p. 576; *J. of H.* v. xxvi., p. 389, fig. 71.) S. A distinct and ornamental species, with slender stem, branched at the base, the leaves 6 in. long, 1½ in. broad, elegantly curved, and coloured green with bands of white. Trop. West Africa. (F. Sander & Co.)

Ephedra trifurca, Torr. (*Gfl.* 1893, p. 535.) Gnetaceæ. An upright bush 2 ft. to 4 ft. high with Equisetum-like branches. Colorado, &c. (Späth, Berlin.)

Epidendrum clæsianum, Hort. (*G. C.* 1893, v. xiii., p. 641.) Orchideæ.

Epidendrum Endresio-Wallisii. (*O. R.* v. i., p. 104.) G. A garden hybrid between the two species indicated in the name. (J. Veitch & Sons.)

Epidendrum forgeteanum, Hort. (*G. C.* 1893, v. xiii., p. 752.) S. "A "pretty new Epidendrum with yellowish "flowers, veined with dull rose." (F. Sander & Co.)

Epidendrum laucheanum, Rolfe. (*K. B.* 1893,. p. 63.) S. A new species allied to *E. grandiflorum,* but with leaves and flowers only half the size; stems, 8 in. long, leafy; leaves narrow, 3 to 6 in. long; racemes terminal many-flowered, the whole of a brownish colour, lip green. New Granada. (F. Sander & Co.)

Epidendrum pumilum, Rolfe. (*K. B.* 1893, p. 171.) G. A new species allied to *E. Endresii.* Stems 5 in. long, with small oblong leaves, and short few flowered racemes of greenish yellow flowers. Costa Rica. (F. Sander & Co.)

Epidendrum tricolor, Rolfe. (*K. B* 1893, p. 63.) G. A new species allied to *E. purum;* stems 5 in. long; leaves 4 in. long; flowers small and numerous, light yellow, with a cucumber-like odour. Venezuela. (H. Low & Co.)

Epidendrum Umlaufti, Zahlbr. (*W. G.* 1893, p. 209, pl.) This is *E. costaricense,* Rchb. f.

Epidendrum wendlandianum, Kränzlin. (*G. C.* 1893, v. xiv., p. 58.) G. A new species allied to *E. tripunctatum;* it has creeping fleshy stems, linear leaves and flowers 2 in. across, the sepals and petals light green, and the lip snow-white, with purple lines on the side lobes. Mexico. (Herrenhausen B. G.)

***Eria albiflora,** Rolfe. (*K. B.* 1893, p. 171.) Orchideæ. S. A new species, near *E. articulata,* Lindl. It is small in all its parts with ovoid pseudobulbs and a short scape of small white flowers. S. India. (Kew.)

***Eucharis Lowii,** Baker. (*G. C.* 1893, v. xiii., pp. 455, 538, fig. 78.) Amaryllideæ. S. A supposed natural hybrid between *E. grandiflora* and *E. Sanderii.* It was imported, with the last-named species, from New Grenada. The flowers are pure white and as large as those of *E. grandiflora.* (H. Low & Co.)

***Eulophia Zeyheri,** Hook. f. (*B. M.* t. 7330.) Orchideæ. S. Previously described by Reichenbach as *E. bicolor,* a name already occupied. It has tuberous roots, bearing annual ensiform leaves 18 in. long and an erect scape over a foot long, bearing at the top six to ten handsome yellow flowers with purple-brown markings on the lip. South Africa. (H. J. Elwes.)

***Euphorbia Sipolisii,** N. E. Br. (*K. B.,* 1893, p. 158.) Euphorbiaceæ. S. A new species of the section *Euphorbium,* stems erect, branching, winged, leafless, ½ in. in diameter; flowers small in sessile cymes. Brazil. (Kew.)

***Exarrhena macrantha,** Hook f. (*B. M.* t. 7291. Boragineæ, H. H. An erect robust herb with hairy stems and leaves, the latter lanceolate, 2 in. to 4 in. long; cymes terminal bifurcate, bearing yellow flowers ½ in. long. New Zealand. (Kew.)

***Fritillaria citrina,** Baker (*Damm. Cat.* 1893, p. 4.) Liliaceæ. H. A very pretty species with bell-shaped pendulous flowers, greenish outside and yellow within. Taurus. (Dammann & Co., Naples.)

***Fritillaria Whittallii,** Baker. (*G. C.* 1893, v. xiii., p. 506.) H. A species closely resembling *F. Meleagris* in habit, leaf and flower; but it has an orbicular instead of a linear nectary. Taurus. (Whittall, Smyrna.)

***Fritillaria zagrica,** Stapf. (*G. C.* 1893, v. xiii., p. 568.) H. A species very closely allied to *F. tulipifolia* and *F. armena*. Flowers dark lurid untesselated, purple glaucous outside. Kashand Mts., Persia. (Max Leichtlin, Baden.)

***Furcræa albispina,** Baker. (*G. C.* 1893, v. xiv., p. 586.) Amaryllideæ. G. A dwarf species allied to *F. depauperata*, with leaves 18 in. long 2 in. wide, with small whitish marginal prickles. Flowers greenish-white on an erect branched scape 6 ft. long. Central America. (Kew.)

***Galanthus byzantinus,** Baker, (*G. C.* 1893, v. xiii., p. 226.) Amaryllideæ. H. This species is intermediate between *G. plicatus*, Bieb. and *G. Elwesii*, Hook. f. It has glaucous leaves broadly channelled down the face with distinctly reflexed edges, as in the former, and inner perianth-segments marked with green, as in the latter. (J. Allen.)

Galanthus corcyrensis, Leichtl., var. **præcox,** (?) Arnott. (*J. of H.* 1893, v. xxvii., p. 549.) H. An early flowering form of the species with broader leaves. (S. Arnott.)

Galanthus Elwesii, Hk. f., var. **robustus,** Hort. (*G.C.* 1893, v. xiii., p. 226.) H. A very robust variety of the type, with a large bulb and thick glaucous leaf. Asia Minor. (Dammann & Co., Naples.)

Galanthus gracilis, Celak. (*G.C.* 1893, v. xiii., p. 656.) H. A closely allied species to *G. Elwesii*, being similar in height and having a large blotch at the base of the inner segments of the perianth. Bulgaria. (Herr Polaky.)

Galanthus grandiflorus, Baker. (*G. C.* 1893, v. xiii., p. 656.) H. A new species remarkable for its very robust habit. The leaves have a recurved edge and are very glaucous beneath. The flowers resemble those of the large forms of G. *nivalis*. (Mrs. Backhouse.)

***Galanthus Ikariæ,** Baker. (*G. C.* 1893, v. xiii., p. 506.) H. A species with the bright green broad leaves of *G. Fosteri*, the quadrate lobes of the inner segments of the perianth with the crisped edges of *G. Elwesii*, and the single apical blotch upon the inner segments of *G. nivalis*. Linn. Nikaria. (Whittall, Smyrna.)

Galanthus maximus, Baker. (*G. C.* 1893, v. xiii., p. 354.) This name has now been sunk, and that of *G. grandiflorus* (which see) adopted.

Galanthus Perryi, Hort. (*G. C.* 1893, v. xiii. p. 258.) H. A species intermediate between *G. caucasicus* and *G. latifolius*. Caucasus. (T. Ware & Son.)

***Galeandra Claesii,** Cogn. (*L.* t. 391.) Orchideæ. S. A new species allied to *G. villosa*. It has slender pseudobulbs about a foot long, blue-green leaves and drooping racemes 9 in. long, bearing six or eight flowers, each about 2 in. across, the sepals and petals brown and the lip rosy. Brazil. (L'Horticulture Internationale.)

Gladiolus Papilio × gandavensis. (*G. C.* 1893, v. xiii., p. 596.) Irideæ. H. H. A garden hybrid between the two plants indicated by the name. (Dammann & Co., Naples.)

***Gladiolus platyphyllus,** Baker. (*G. C.* 1893, v. xiv., p. 456.) H. H. A new species, not unlike *G. dracocephalus* in general characters, but with broader, shorter opposite leaves, and a tall spike of deep yellow flowers veined with red. Natal. (Kew; Max Leichtlin.)

Gladiolus Victorialis, Sprenger. (*G.C.* 1893, v. xiii., p. 596.) H. H. A garden hybrid between *G. communis* and *G. cardinalis* or *G. Colvillii*. Dammann & Co., Naples.)

Gongora Charlesworthii, Rolfe. (*O. R.* v. i., p. 198.) Orchideæ. S. A new species with the habit of *G. truncata*; leaves plicate, a foot long, $2\frac{1}{2}$ in. broad; scape arching $1\frac{1}{2}$ ft. long, bearing about 20 flowers, which are 2 in. wide, nearly white, barred with a very light brownish purple. Habitat not recorded. (Charlesworth, Shuttleworth & Co.)

Graderia subintegra, M. T. Mast. (*G. C.* 1893, v. xiv., p. 798, fig 122.) Scrophularineæ. G. A new species with a woody rootstock, trailing branches, ovate acute hairy leaves, and erect racemes of Gloxinia-like rosy lilac flowers. Probably semi-parasitic. S. Africa. (Seeds offered by W. Nelson, Johannesburg.)

***Grammatophyllum sanderianum,** Hort. (*G. C.* 1893, v. xiv., p. 15.) Orchideæ, S. A clerical blunder, the plant intended being *G. speciosum.*

***Habenaria cinnabarina,** Rolfe. (*K. B.* 1893, p. 173.) Orchideæ. S. A new species of dwarf habit, with erect linear leaves 6 in. long, and an erect spike 6 in. long, bearing a dense cluster of small orange-red flowers. Madagascar. (W. L. Lewis & Co.)

***Habenaria gigantea,** Hook., var. **sumatrana,** (*G. & F.* 1893, v. vi., p. 336.) S. *H. gigantea* (see *Bot. Mag.* t. 3,374.) is a synonym of *H. Susannæ,* Br. The variety is described as having large white flowers on erect scapes, with a large three lobed labellum. Sumatra. (F. Sander & Co.)

***Hapaline Brownii,** Hook. f. (*B. M.* t. 7,325.) Aroideæ. S. A new species with the habit of a *Spathicarpa,* from which it differs mainly in having the spadix free from the spathe; it has green cordate leaves and a greenish white inflorescence. Malayan Peninsula. (Kew.)

Hedera Helix, L. var. **tessellata.** (*Gard.* 1893, v. 44, p. 150.) Araliaceæ. "A distinctly marked form of the " common ivy, with veinings after the " manner of the variegated Japanese " honeysuckle." (Miss Browning.)

Hedraeanthus niveus, G. Beck. (*W. G.* 1893, p. 288, f. 63.) Campanulaceæ, H. A dwarf plant with grassy leaves, stem and bracts purple, calyx reddish, corolla snow-white. Alps of Bosnia.

Heliconia illustris, M. T. M. (*G. C.* 1893, v. xiii., p. 413.) Museæ. S. A beautiful foliage plant with Musa-like habit, the leaves coloured rose-red with the veins clearly marked in rose pink. South Sea Islands. (W. Bull.) [Heliconia is wild only in America. *H. Bihai* is naturalised in Polynesia and Tropical Asia. Probably H. illustris is some form of this.]

Heuchera rosea, Zabel. (*M. G. Z.* 1893, p. 2.) Saxifrageæ. H. A garden hybrid between *H. pilosissima,* F. & M., and *H. sanguinea,* Engelm. (Zabel, Münden.)

Hibiscus crassinervis, F. var. **flammea,** Schwfth. (*Gfl.* 1893, p. 494.) Malvaceæ. G. A dwarf showy annual (perennial when grown under glass) with small heartshaped glandular leaves and long-stalked fiery red flowers. Abyssina. (Dammann & Co., Naples.)

Hibiscus Lebelei, Naudin. (*R. H.* 1893, p. 449.) H. H. An unbranched species 3 ft. to 4½ ft. high, with palmate, digitate leaves and large flowers, lemon yellow with red brown blotches at the base of the corolla. China. (Naudin, Antibes.)

Hoplophytum lineatum, Hort. (*G. C.* 1893, v. xiii., p. 412.) Bromeliaceæ. S. A striking plant with cylindrical tufts of leaves coloured green with stripes of white, the marginal spines black. Brazil. (W. Bull.) [Until the plant flowers the genus is uncertain.]

***Huernia Sprengeri,** Hort. (*W. G.* 1893, p. 143, f. 30.) Asclepiadeæ. S. A species with gold bronze, star-shaped, white-centred flowers. Abyssinia. (Dammann & Co., Naples.)

***Hymenocallis concinna,** Baker. (*G. C.* 1893, v. xiv., p. 150.) Amaryllideæ. S. A new species resembling *H. caribæa,* but evergreen and smaller in all its parts; leaves an inch wide, flowers white. Said to be quite hardy in Naples. Mexico. (Dammann & Co., Naples.)

Hypolytrum schraderianum, Nees. (*G. C.* 1893, v. xiii., p. 414.) Cyperaceæ. S. A stout grass-like plant with tufted leaves 2½ ft. long and 2 in. wide, entire, green with purple margins. Brazil. (W. Bull.)

***Ilex conocarpa,** Reiss. (*B. M.* t. 7310.) Ilicineæ. G. A shrub about 6 ft. high with lanceolate serrulate leaves 4 in. long, and short axillary racemes of small white flowers. Interesting as being one of the plants which yield "Mate" or Paraguay tea. Brazil. (Kew.)

***Impatiens auricoma,** Baill. (*Jard.* 1893, p. 52.) (Geraniaceæ. S. Plant glabrous about 2 ft. high with a fleshy stem and opposite lanceolate leaves, the stalks of which bear stalked glands on their upper portions. Flowers bright yellow with a short bifid curved spur. Comoro Islands. (Landry, France.)

***Incarvillea Delavayi,** Franch. (*R. H.* 1893, p. 544; *Jard.* 1893, p. 58, f. 20.) Bignoniaceæ. H. H. A nearly stemless almost hardy herbaceous plant with pinnatipartite leaves and raceme of red or deep rose-coloured flowers. China. (Vilmorin, Paris.)

Iris Athoa, Foster. (*G. C.* 1893, v. xiii., p. 711.) Irideæ. H. A more robust sp. than *I. subbiflora,* to which it comes very near. Flowers, brownish-red-purple in colour. Mt. Athoa. (M. Foster.)

***Iris atrofusca,** Baker (*G. C.*, 1893, v. xiii., p. 384.) H. A distinct species, tall as *Iris susiana*, but the outer segments of the perianth are much shorter and a concolorous brown-black. Palestine. (Herb and Wulle, Naples.)

Iris caroliniana, Wats. (*G. and F.*, 1893, v. vi., p. 334, f. 51.) A species nearly allied to *I. versicolor*. N.Carolina. (Manda.)

Iris germanica, L., var. **gypsea,** Rodigas. (*Ill. H.* 1893, t. 182.) H. A form with pale pearly-white flowers. (L'Horticulture Internationale.)

***Iris Grant-Duffii,** Baker. (Damm. Cat. 1893, p. 5.) H. A species closely allied to *I. sibirica* and *I. tenax*, with yellow and yellowish-white flowers, veined violet. - Palestine. (Dammann & Co., Naples.)

Iris Haynei, Baker. (Damm. Cat. 1893, p. 5.) H. An Oncocyclus species with upright glaucous leaves, and large elegant flowers of a dark grey colour, dotted black. Palestine. (Dammann & Co., Naples.)

***Iris Mariæ,** Barb. (I. Helenæ, Bak.) (*G. M.* 1893, p. 242.) A dwarf elegant species with falls of a claret colour, and having a black crimson blotch in the centre of base. Standards lilac with darker veins. Palestine. (T. Ware & Son.)

***Iris Sari,** Schott, var. **nazarene,** Foster. (*G. M.* No. 2059, p. 211.) A beautiful Iris of the Oncocyclus group, in general appearance near *I. Lortetii.* The falls are heavily marked with rows of brown-purple spots on a straw coloured ground and have a large maroon blotch in the centre, standards creamy white with blue veins. Palestine. (T. Ware & Son.)

Kalanchoe grandiflora, Hort. Dammann & Co. is *K. marmorata*, which see in *Kew Bulletin*, App. II. 1893, p. 38.

***Kniphofia citrina,** Baker. *G. C.* 1893, v. xiv., p. 552.) Liliaceæ. H. H. A new species with leaves and peduncle like *K. Macowani*, but with shorter pale yellow flowers and exserted stamens. It is hardy and flowers in October. S. Africa. (Max Leichtlin, Baden.)

Kniphofia longicollis, Leitchlin. (*G. C.* 1893, v. xiii., p. 683.) H. H. A new species, dwarfer than *K. aloïdes*, with bright green ensiform leaves, short racemes, and large clear yellow flowers produced in May. Natal. (Max Leitchlin, Baden.)

***Kniphofia modesta,** Baker. (*B. M.* t. 7293.) H. H. Described in 1889 from plants cultivated at Kew, but not included in the list of new plants for that year. It is distinct in having linear pale green smooth edged leaves 2 ft. or more long, and a slender erect panicle 2 ft. high of white flowers $\frac{1}{3}$ in. long. Natal and Griqualand. (Kew.)

***Kniphofia pauciflora × Macowani.** (*G. C.* 1893, v. xiv., p. 424.) H. H. A garden hybrid between the two species indicated by the name. (Kew.)

Kniphofia Tuckii, Hort. Leichtlin. (*G. C.* 1893, v. xiii., p. 68.) A species resembling *K. pumila*, but differing in its shorter, broader, green leaves, the perianth tube widening from base to throat, and less exserted stamens. Colesberg. (Max Leichtlin, Baden.)

Lachenalia aurea, Lindl. var. **gigantea,** Hort. (*G. C.* 1893, v. xiii., pp. 290, 364.) Liliaceæ. G. Differs from the type in having taller and stouter flower scapes. A plant at Kew in December bore spikes 19 inches high with 27 open flowers.

Lælia Euterpe. (*G. C.* 1893, v. xiv., p. 536.). Orchideæ. S. A garden hybrid between *L. crispa* and *L. dayana.* (T. Statter.)

Lælia finckeniana, O'Brien. (*G. C.* 1893, v. xiii., p. 194; xiv., p. 806, fig. 123.) S. A supposed natural hybrid between *L. autumnalis* and *L. anceps*, but probably only a variety of the latter species. (C. W. Fincken).

***Lælia lucasiana,** Rolfe. (*O. R.*, v. i., p. 265.) S. A new species, allied to *L. crispilabia*, from which it differs in having a yellow lip; the other parts of the flower being purplish-mauve. Habitat not recorded. (C. J. Lucas.)

Lælia Maynardii. (*G. C.* 1893, v. xiii., pp. 206, 715, fig. 108.) S. A garden hybrid between *L. pumila*, var *dayana* and *L. dolosa.* (F. Sander & Co.)

Lælia Normanni. (*G. C* 1893, v. xiii., p. 98.) S. A garden hybrid between *L. pumila*, var. *marginata* and *Cattleya dowiana.* (N. C. Cookson.)

Lælia Novelty. (*G. M.* 1893, p. 500, fig.) S. A garden hybrid between *L. elegans* and *L. pumila* var. *dayana.* (J. Veitch & Sons.)

Lælia Oweniæ, L. Lind. (*L.* t. 374.) S. A supposed natural hybrid between *L. Perrinii* and *L. elegans.* (G. D. Owen.)

Lælia purpurata, Lindl., var. **discolor,** Rolfe. (*O. R.*, v. i., p. 199.) S. A variety with bluish-white sepals and purple-veined petals. (W. Brown.)

Lælia purpurata, Ldl. var. **fastuosa,** Hort. (*L.* t. 385.) S. A large-flowered variety with rose-purple sepals and petals and a deep maroon lip. (L'Horticulture Internationale.)

Lælia purpurata, Ldl., var. **nobilis,** Hort. (*G. C.* 1893, v. xiii. p. 641.) S. A variety with richly-marked flowers. (F. Sander & Co.)

Lælia purpurata, Ldl., var. **purpurea,** Hort. (*G. C.* 1893, v. xiii., p. 641.) S. A variety with darker-coloured flowers than usual. (J. Cypher & Son.)

Lælia Sanderæ. (*G. C.* 1893, v. xiv., p. 406.) S. A garden hybrid between *L. xanthina* and *L. dormaniana*. (F. Sander & Co.)

Lælio vitellina, O'Brien. (*G. C.* 1893, v. xiii., pp. 336, 365, fig. 53.) G. A supposed hybrid between *L. harpophylla* and *L. Perrinii* (Baron Schrœder.)

Lælio-Cattleya albanensis, Rolfe. (*G. C.* 1893, v. xiv., p. 584.) S. A supposed natural hybrid between *Cattleya Warneri*, and *Lælia grandis*. It has pseudobulbs like those of the Cattleya but longer, and flowers 5 in. across, coloured as in the Cattleya, with wavy petals. Bahia. (F. Sander & Co.)

Lælio-Cattleya amæna, var. **delicata.** (*L.* t. 367.) S. A garden hybrid between *Cattleya Loddigesii* and *Lælia Perrinii*. (A. Bleu, Paris.)

Lælio-Cattleya Ascania. (*G. C.* 1893, v. xiii., p. 518; *J. of H.* v. xxvi., p. 351, fig. 65.) S. A garden hybrid between *Cattleya Trianæ* and *Lælia xanthina*. (J. Veitch & Sons.)

Lælio-Cattleya Epicasta. (*G. C.* 1893, v. xiv., p. 342.) S. A garden hybrid between *Lælia pumila* and *Cattleya Warscewiczii*. (J. Veitch & Sons.)

Lælio-Cattleya Eumæa. *G. C.* 1893, v. xiv., p. 536.) S. A garden hybrid between *Lælia majalis* and *Cattleya labiata* var. *Trianæ*. (J. Veitch & Sons.)

Lælio-Cattleya Nysa. (*G. C.* 1893, v. xiv., p. 343; *O. R.* v. i., p. 307.) S. A garden hybrid between *Cattleya Warscewiczii* and *Lælia crispa*. (J. Veitch & Sons.)

Lælio-Cattleya Pisandra. (*G. C.* 1893, v. xiv., p. 536; *J. of H.* v. xxvii., p. 407, fig. 60.) S. A garden hybrid between *Lælia crispa* and *Cattleya labiata* var. *Eldorado*. (J. Veitch & Sons.)

Lælio-Cattleya ridolfiana. (*B. T. O.* 1893, p. 72, t. 3.) A garden hybrid between *Lælia purpurata* var. *aurora* and *Cattleya Mossiæ*, var. *picta*. (Pucci, Italy.)

Lælio-Cattleya Sanderæ. (*O. R.* v. i., p. 363.) S. A garden hybrid between *Lælia xanthina* and *Cattleya dormaniana*. (F. Sander & Co.)

Lælio-Cattleya statteriana. (*G. C.* 1893, v. xiv., p. 631; *J. of H.* v. xxvii. p. 463, fig. 67.) S. A garden hybrid between *Lælia Perrinii* and *Cattleya labiata*. (J. Veitch & Sons.)

Lamprococcus speciosus, Hort. (*G. C.* 1893, v. xiii., p. 414.) Bromeliaceæ. S. An ornamental leaved plant, the leaves tufted, leathery finely toothed, bright green, with broad longitudinal stripes of yellow. Brazil. (W. Bull.) [Until this plant flowers the genus is uncertain.]

Lathyrus splendens, Kellogg. (*G. C.* 1893, v. xiii., p. 258.) Leguminosæ. H. A species with large pea-shaped flowers of great beauty. The foliage is very variable and the flowers are scarlet-purple in colour. Lower California.

***Leptactinia Mannii,** Hook, f. (*G. & F.* 1893, v. vi., p. 424.) Rubiaceæ. S. A shrub with Randia-like habit and large white fragrant flowers in terminal clusters. W. Trop. Africa. (Kew.)

Lilium croceo-elegans, (*G. C.* 1893 v. xiv., p. 8.) Liliaceæ. H. A hybrid between *L. croceum* and *L. elegans*. (Dammann & Co., Naples.)

***Lilium dalhansoni.** (*Gard.* 1893, v. 44, p. 260.) H. A hybrid between *L. Martagon* var. *dalmaticum*, and *L. Hansoni*. (Powell, Tunbridge Wells.)

***Lilium japonicum,** Thunb. var. **Alexandræ,** Baker. (*G. C.* 1893, v. xiv., pp. 86, 243, fig. 44.) H. A variety which differs from the type in its broader leaves, more open flowers, which are pure white, and longer style. Syns. *L. Ukeyuri, L. Alexandræ*, Hort. Japan. (J. Veitch & Sons, Wallace & Sons.)

Lilium Martagon, L. var. **villosum,** Perona. (*B. T. O.* 1893, p. 70.) A form differing from the type by its larger leaves, deeper coloured flowers, and by the long white hairs which clothe the unopened buds. The flowers are produced about a fortnight after those of the type. N. Italy.

Lobelia Gerardi, Sauv. (*R. H.* 1893, p. 519.) Campanulaceæ. H. A garden hybrid between *L. cardinalis*, and *L. syphilitica*.

***Lonicera hildebrandiana,** Collett and Hemsl. (*G. C.* 1893, v. xiv., p. 743.) Caprifoliaceæ. G. This is the largest flowered of all Honeysuckles. It was discovered in Upper Burma by General Collett five years ago, who described it as "A conspicuous shrub, with large "dark glossy leaves and fine crimson "flowers, 7 ins. long." (Kew.)

Lonicera mündeniensis. (*Gfl.* 1893, p. 102, fig. 18, 4–6.) H. A garden hybrid between *L. bella* and *L. gibbiflora.* A bush with arching branches and erect softly hairy twigs. Fl. white or yellowish white, fruit ovoid, red. (Münden Forest School.)

Lonicera muscaviensis. (*Gfl.* 1893, p. 100, fig. 18, 1–3.) H. A hybrid between *L. Morrowii* and *L. ruprechtiana.* Intermediate in character between the two parents; flowers white, fruit red. (Muskau, Germany.)

Lonicera Zabelii. (*Gfl.* 1893, p. 104, fig. 19, 1–3.) H. A garden hybrid between *L. floribunda* and *L. tatarica* A bushy shrub with shortly stalked, egg-shaped leaves and bright dark rose-coloured flowers. Fruit small, round, coral-red. (Münden Forest School.)

***Ludovia crenifolia,** Drude. (*G. C.* 1893, v. xiii., p. 442, fig. 64.) Cyclanthaceæ. S. A large plant of tufted habit, the leaves sheathing at the base and set in two ranks, thick, leathery plicate, lanceolate above, narrowed to a stalk-like base. Brazil. (F. Sander & Co.)

Luffa Forskalii, Hort. (*B. T. O.* 1893, p. 12, fig. 1.) Cucurbitaceæ. S. A pretty climber with sulphur-yellow flowers, small ovoid ribbed fruits and black seeds. Arabia, &c. (Dammann & Co., Naples.)

***Luisia amesiana,** Rolfe. (*G. C.* 1893, v. xiii, p. 751, xiv., p. 32, fig. 8, also p. 218.) Orchideæ. S. A new species with terete leaves and clusters of flowers. Sepals and petals ovate, greenish yellow; lip large, lobed, spotted with dull red. First introduced by Messrs. H. Low & Co. in 1890, but name not published. Burma. (Sir T. Lawrence.)

Luisia Volucris, Lindl. (*G. C.* 1893, v. xiii., p. 751; xiv., p. 32, fig. 9.) S. Leaves terete, flowers solitary in the axils, with linear oblong yellow sepals and petals, the petals horn-like, the lip fleshy, brown-purple, pressed close to the stem. (Sir T. Lawrence.)

Lycaste cinnabarina, Rolfe. (*O. R.* v. i., p. 303; *L.*, t. 394.) Orchideæ. G. A new species allied to *L. mesochlæna.* It has large, broad leaves and erect single-flowered scapes, each flower being 4 in. across, the sepals and petals white with a tinge of green, and the lips apricot-red. Peru. (L'Horticulture Internationale.)

Lycaste imschootiana, Hort. Linden. (*G. C.* 1893, v. xiv., pp. 756, 775, fig. 119.) G. A new species with the habit of *L. Skinneri*, and large flowers in which the sepals are pale brown with small purple spots, the petals and lip yellow with red dots. Subsequently it was stated that this is the result of crossing *L. Skinneri* with *Maxillaria nigrescens.* (L'Horticulture Internationale.

Lycaste Luciani, Hort. Linden. (*G. C.* 1893, v. xiv., p. 756.) G. A new species allied to *L. lasioglossa*; the sepals pale brown with pink spots, the petals white with rosy dots, the lip pink and white. (L'Horticulture Internationale.)

***Lycaste macrobulbon,** Lindl. var. **Youngii,** Rolfe. (*L.* t. 368.) G. This plant has been in cultivation for some years under the name of *L. Youngii.* It is probably nothing more than Lindley's *L. macrobulbon,* of which a figure was published in *Bot. Mag.* t. 4228 as *Maxillaria macrobulbon.*

Lycaste rossiana, Rolfe. (*O. R.* vi., p. 239.) G. A new species allied to *L. cruenta,* but with smaller flowers and a differently formed lip. The sepals are oblong acute, greenish yellow; the petals are broader, deep orange yellow with a few brown spots near the base, and the lip is three-lobed, yellow, faintly barred with brown. Habitat not recorded. (H. J. Ross, Florence.)

Lycaste schœnbrunnensis. (*O. R.* v. i., p. 51; *W. G.* 1893, p. 287, pl.) A garden hybrid between *L. Skinneri* and probably *L. schilleriana.* (Emperor of Austria.)

Lycaste Skinneri, Lindl. var. **purpurea,** Hort. (*L.*, t. 379.) G. A variety with pale rose sepals, rose-purple petals and a white lip slightly tinged with yellow. (L'Horticulture Internationale.)

Magnolia stricta, Hort. (*Gard.* 1893, v. 14, p. 391.) Magnoliaceæ. H. "A "cross between *M. soulangeana* and "*M. obovata.*" (John Saul, United States.)

Malva hastata. Hort. (*B. T. O.* 1893, p. 108, f. 15.) Malvaceæ. H. A branched annual with large long-stalked rose-violet flowers. Mexico. (Dammann & Co., Naples.)

***Maranta Leonæ**, Hort. (*G. C.* 1893, v. xiii. p. 751.) Marantaceæ. S. A low growing plant with ovate leaves, the blade 6 in. long and the petiole about the same length, both covered with soft silky hair, and coloured green with grey variegation. (F. Sander & Co.)

Masdevallia burbidgeana, Rolfe. (*O. R.* v. i., p. 265.) Orchideæ. G. A new species of the Saccolabiatæ. Leaves 5 in. long, tufted; flower tube less than half an inch across; sepals an inch long, lateral united half way, greenish yellow with brown spots and yellow hairs, lip yellowish. New Grenada. (Glasnevin.)

Masdevallia Chimæra, Rchb. f. var. **vanneriana.** (*O. R.* v. i., p. 206.) G. A variety of garden origin, the result of crossing *M. Chimæra* var. *Wallisii* with *M. Chimæra* var. *Roezlii.* (W. Vanner.)

Masdevallia fragrans, Woolward. (*G. C.* 1893, v. xiv., p. 160.) G. A new species with leaves like *M. elephanticeps*, and cupped yellowish flowers with short fleshy tails, much like those of M. pachyantha in shape. New Grenada. (Lord Lothian.)

Masdevallia harryana, Vars. (*L.* t. 382.) G. Five named varieties are figured and described here; the varietal names are *Kegeljani*, *lilacina*, *carnea*, *reginæ*, and *illustris.* (L'Horticulture Internationale.)

Masdevallia Henrietta. (*G. C.* 1893, v. xiii., p. 740.) G. A garden hybrid between *M. Shuttleworthii* and *M. ignea.* (F. L. Ames, New York.)

Masdevallia Parksii. (*G. C.* 1893, v. xiii., p. 636.) G. A garden hybrid between *M. harryana* and *M. ignea.* (Heath & Son.)

Masdevallia Pourbaixii, Hort. (*L.* t. 387.) G. A garden hybrid between *M. veitchiana* and *M. Shuttleworthii.* (E. Pourbaix, Mons.)

Masdevallia pusilla, Rolfe. (K. B. 1893, p. 335.) G. A new species near *M. Troglodytes.* Leaves lanceolate, 6 in. long; scape 4 in. long, flexuous, flowers the smallest in the group, yellowish, with purple-brown blotches. Habitat not recorded. (Glasnevin.)

Masdevallia Rebecca. (*G. C.* 1893, v. xiii., p. 740.) G. A garden hybrid between *M. ignea* and *M. amabilis.* (F. L. Ames, New York.)

Masdevallia Rushtoni. (*O. R.* v. i., p. 210.) G. A garden hybrid between *M. ignea*, var. *Eckhardii*, and *M. racemosa*, var. *Crossii.* (Captain Hincks.)

Masdevallia veitchiano-Estradæ. (*G. C.* 1893, v. xiii., p. 724, O. R. v. 1, p. 211.) G. A garden hybrid between the two species indicated by the name. (Capt. Hincks,)

Maxillaria sanderiana, Rchb. f. var. **xanthoglossa,** Hort. (*J. of H.* 1893, v. xxvi., p. 494, fig. 89.) Orchideæ. S. A variety with an exceptional number of crimson spots on the segments and a yellowish lip. (F. Sander & Co.)

Maxillaria striata, Rolfe. (*O. R.* v. i., p. 266., *L.* t. 398.) G. A new species with the habit of *M. venusta*, and large flowers 5 in. across, the sepals and petals greenish yellow with brown purple stripes, and the lip white with amethyst purple vein-like lines. Peru. (L'Horticulture Internationale.)

***Megaclinium minutum,** Rolfe. (*B. M.* t. 7314; *K.B.* 1893, p. 5.) Orchideæ. S. A diminutive species with a creeping rhizome, small ovate pseudobulbs bearing each a pair of small leaves; scape short, flattened, purple, with two rows of small orange-red flowers. Sierra Leone. (Kew.)

***Melothria abissinica,** Naudin. (*B. T. O.* 1893, p. 13, fig. 2.) Cucurbitaceæ. G. or S. A perennial climber with very small yellowish flowers, followed by small round orange-coloured fruits, produced in great profusion in autumn. Abyssinia. (Dammann & Co., Naples.)

Miltonia joiceyana, O'Brien. (*G. C.* 1893, v. xiv., p. 206.) Orchideæ. S. Supposed to be a natural hybrid between *M. Clowesii* and *M. candida.* It has flowers 3 in. across coloured yellow, with brown blotches. Brazil. (Major Joicey.)

***Momordica chinensis,** Hort. (*B. T. O.* 1893, p. 14, fig. 4.) Cucurbitaceæ. S. Similar to *M. Charantia*, but differing from that species in its much larger, longer fruits of a silvery colour. China. (Dammann & Co., Naples.)

Momordica muricata, Hort. (*B. T. O.* 1893, p. 14.) S. A vigorous annual climber with pale yellow flowers, and golden or orange-yellow fruit with blood-red pulp and white seeds. Peru. (Dammann & Co., Naples.)

Mormodes igneum, Lindl. var. **maculatum,** Rolfe. (*L.*, t. 364.) Orchideæ. S. A variety with yellowish brown sepals and petals spotted with purple brown, and a coppery red labellum. (L'Horticulture Internationale.)

***Musa Hillii**, F. v. M. (*G. C.* 1893, v. xiv., p. 743.) Museæ. S. An Australian species of the *M. sapientum* group. It has a stout stem, large leaves, and an erect peduncle bearing whorls of white flowers, succeeded by small ovoid fruits. Queensland. (Kew.)

***Musa Mannii**, Wendl. (*B. M.* t. 7311.) S. A dwarf species, the stems not exceeding 4 ft. in height, with elegant leaves 3 ft. long by 7 in. broad, and an erect spadix bearing several conspicuous boat-shaped bracts of a rose-crimson colour. The flowers are in threes and yellow, and the fruit small, angular, and green. Assam. (Kew.)

Narcissi Hybrids. (*G. C.* 1893, v. xiii., p. 385.) Amaryllideæ. A number, of which the probable parents are given, are here described.

Narcissus intermedius. (Damm. Cat. 1893, p. 5.) H. A garden hybrid between *N. Jonquilla* and *N. Tazetta*, (Dammann & Co., Naples.)

Neodryas sacciana, Lind. et Cogn. (*J. O.* 1893, p. 73.) Orchideæ. G. A new species with the habit of a small Oncidium, and small flowers coloured dull purple with a yellow lip. The genus is closely allied to Mesospinidium. Bolivia. (L'Horticulture Internationale.)

Nepenthes amesiana. (*G. C.* 1893, v. xiv., p. 756.) Nepenthaceæ. S. A garden hybrid between *N. rafflesiana* and *N. hookeriana*. (J. Veitch & Sons.)

Nepenthes mixta. (*G. C.* 1893, v. xiii., p. 46, fig. 9.) S. A garden hybrid between *N. northiana* and *N. Curtisi*. (J. Veitch & Sons.)

***Nerine elegans** var. **alba**, Hort. (*J. of H.* 1893, v. xxvii., p. 349, fig. 51.) Amaryllideæ. G. A distinct plant with an erect scape bearing an umbel of nearly a dozen pure white flowers. Said to be an introduction from S. Africa, and therefore not likely to be a form of *N. elegans*, which is a hybrid of garden origin. It comes near *N. Moorei*. (T. Ware.)

Nerine mutabilis. (*G. C.* 1893, v. xiii., p. 130.) G. A garden hybrid between *N. humilis* and *N. pulchella*. (R. A. Todd.)

***Nicotiana colossea**, André, var. **variegata.** (*R. H.* 1893, p. 9.) Solanaceæ. G. A variegated form of the plant described, *B. M.* t. 7252, as *N. tomentosa*. (Sallier, Paris.)

Nidularium digeneum. (*W. G.* April 1893.) Bromeliaceæ. A garden hybrid between *N. Innocenti* and *Bromelia nitens*. (Hübsch, Bavaria.)

Nothochlæna mollis, Hort. (*G. C.* 1892, v. xiii., p. 638.) Filices. G. "Fronds light green, silvery powdered "beneath; habit dense, compressed, as "are the divisions of the fronds." (W. & J. Birkenhead.)

Nymphæa Laydekeri fulgens. (*Gard.* 1893, v. xliv., p. 297.) Nympheaceæ. H.? A seedling variety, said to be of hybrid origin and hardy. Flowers 3½ in. in diameter, petals dark crimson. (Latour-Marliac, France.)

Nymphæa Laydekeri liliacea. (*Gard.* 1893, v. xliv., p. 297.) A seedling variety, said to be of hybrid origin and hardy. Flowers 2½ in. in diameter, petals rose-coloured. (Latour-Marliac, France.)

Nymphæa marliacea ignea. (*Gard.* 1893, v. xliv., p. 297.) A seedling variety, said to be of hybrid origin and hardy. Flowers nearly 5 in. in diameter, petals bright rosy crimson. (Latour-Marliac, France.)

Nymphæa marliacea rubra punctata. (*Gard.* 1893, v. xliv., p. 297.) A seedling variety, said to be of hybrid origin and hardy. Flowers 4 in. in diameter, petals deep rose purple and marbled. (Latour-Marliac, France.)

Nymphæa Robinsoni. (*Gard.* 1893, v. xliv., p. 297.) A seedling variety, said to be of hybrid origin and hardy. Flowers 4 in. in diameter, petals broad, coloured soft terra-cotta rose shaded with yellow. (Latour-Marliac, France.)

***Nymphæa Trickeri.** (*G. and F.*, 1893, v. vi., p. 464.) S. A garden hybrid between *N. dentata* and *N. Sturtevantii*. (J. N. Gerard, New Jersey.)

Odontoglossum baphicanthum, Rchb. f. var **immaculatum**, Rolfe. (*O.R.*, v. i., p. 199.) Orchideæ. G. A variety with primrose-yellow flowers without any spots. (F. Sander & Co.)

Odontoglossum blandum, Rchb. f. var. **albo-cupreum**, O'Brien. (*G. C.* 1893, v. xiii., p. 355.) G. A variety with primrose-coloured flower segments banded instead of spotted with red-brown. (C. Vuylsteke, Ghent.)

Odontoglossum crispum, Lindl. var. **amplissimum**, Hort. (*G. C.* 1893, v. xiv., p. 756.) G. A variety with large broad pure white segments, and a yellow blotch on the lip. (L'Horticulture Internationale.)

Odontoglossum crispum, Lindl. var. **ferrierense,** Hort. (*L.* t. 381.) G. A variety with large flowers, the segments of which bear each a large red-purple blotch on a rose-tinted ground. (L'Horticulture Internationale.)

Odontoglossum crispum, Lindl. var. **owenianum,** Hort. (*G. C.* 1893, v. xiii., p. 636.) G. A variety with large flowers heavily spotted with dark yellow on a white ground. (F. Sander & Co.)

Odontoglossum crispum, Lindl. var. **Thompsoniæ,** Hort. (*G. C.* 1893, v. xiv., p. 756.) G. A variety with large full flowers, pure white with blotches of rich brown red on the petals. (L'Horticulture Internationale.)

Odontoglossum Insleayi, Barker var. **imschootianum,** Hort. (*L.* t. 359.) G. A variety with flowers of a yellowish hue as in the variety called *aureum.* (L'Horticulture Internationale.)

***Odontoglossum Krameri,** Rchb. f. var. **album,** Rolfe. (*O. R.* v. i., p. 200.) G. A variety without any rose purple colour in the flowers. (Kew.)

Odontoglossum Kränzlinii, O'Brien. (*G. C.* 1893, v. xiii., p. 442.) G. A new species similar to *O. elegans,* with flowers 2 in. across coloured pale yellow with brown blotches, and a lanceolate labellum which is white with a velvety brown blotch in front, and a few purple spots at the sides. Columbia. (F. Sander & Co.)

Odontoglossum lanceans var. **gravesianum,** O'Brien. (*G. C.* 1893, v. xiii., p. 322.) G. A variety with creamy white sepals and petals spotted with red-purple. (F. Sander & Co.)

Odontoglossum luteopurpureum, Lindl., var. **cobbianum,** Hort. (*O. R.* v. i., p. 34.) G. A variety with sepals and petals coloured almost wholly deep chestnut, the latter marked with a broad greenish yellow band. (W. Cobb.)

Odontoglossum mulus, Rchb. f. var. **statterianum,** Hort. (*G. C.* 1893, v. xiii., p. 636.) G. A variety with exceptionally large and richly marked flowers. (T. Statter.)

Odontoglossum Pescatorei, Lind. var. **Lewisii,** Hort. (*O. R.* v. i., p. 135.) G. A variety with medium sized flowers, white, unspotted, suffused with purple, the lip marked with a large blotch of violet-purple. (W. L. Lewis & Co.)

Odontoglossum ramosissimum, Lindl. var. **coeleste,** Lind. et Rod. (*Ill. H.* 1893, tab. 170.) G. This variety differs from the type in the flowers being tinted with mauve instead of being spotted with that colour on a white ground. (L'Horticulture Internationale.)

Odontoglossum roebelinianum, Hort. (*G. C.* 1893, v. iii., p. 518.) G. A supposed natural hybrid. (F. Sander & Co.)

Odontoglossum ruckerianum, Rchb. f. var. **splendens,** O'Brien. (*G. C.* 1893, v. xiii., p. 385.) G. A large flowered richly marked variety of what is a supposed natural hybrid. (Sir T. Lawrence.)

Odontoglossum thompsonianum, Garnier. (*L.* t. 388.) G. A form of *O. luteopurpureum* with broad segments, the blotches large and deep chocolate in colour, the lip being white with a blot of orange yellow. (L'Horticulture Internationale.)

Odontoglossum Uroskinneri, Lindl., var. **album,** Hort. (*G. C.* 1893, v. xiv., p. 470; *O. R.* v. i., p. 334.) G. A variety with a pure white lip. (Major-Gen. Berkeley.)

Odontoglossum wilckeanum Rchb. f. var. **elegans,** Rolfe. (*O. R.* v. i., p. 135.) G. A variety with yellow sepals blotched with brown, primrose coloured petals and lip with a few small chestnut spots. (Austen & McAslan.)

Oncidium luteum, Rolfe. (*K. B.* 1893, p. 172.) Orchideæ. G. A new species allied to *O. chrysopyramis,* pseudobulbs ovate, over an inch long; leaves 4 in. long; panicle 18 in. long; flowers numerous, small, light yellow. Habitat not recorded. (Sir T. Lawrence.)

***Oncidium sanderianum,** Rolfe. (*K. B.* 1893, p. 337; *G. and F.,* v. vi., pp. 336, 515.) G. A new species, allied to *O. serratum.* It is described as free flowering with thickly branched scapes of large "rosy red" blossoms. They also have been described as chocolate-brown. Peru. (F. Sander & Co.)

Oncidium unicolor, Rolfe. (*O. R.,* v. i., p. 266.) G. A new species allied to *O. uniflorum,* but of more robust habit with larger flowers, which are of a uniform yellow colour. Brazil. (W. Bull.)

Oncidium zonatum, Cogn. (*J. O.* 1893, p. 76.) G. A new species allied to *O. bryolophotum.* It has heteromorphous flowers, the sepals white, the petals yellow with transverse brown bands. Columbia. (L'Horticulture Internationale.)

***Ornithogalum natalense,** Baker. (*G. M.* 1893, p. 557.) Liliaceæ. This species is very closely allied to *O. hispidum*, and is found at an altitude of 6,800 ft. Natal. (Kew.)

***Osteomeles anthyllidifolia,** Lindl. (*Lemoine Cat.* 1893; *G. C.* 1893, v. xiv. pp. 628, 743.) Rosaceæ. H. A shrub with twiggy branches, pinnate leaves and corymbs of white fragrant hawthorn-like flowers. It forms extensive thickets in Upper Burma, and is eaten by cattle. China, India, &c. (Jardin des Plantes, Paris.)

Oxalis anthelminthica, A. Br. (Damm. Cat. 1893, p. 5.) Geraniaceæ. G. A charming species with purple or lilac flowers. Abyssinia. (Dammann & Co., Naples.)

***Oxytenanthera abyssinica,** Munro. (*K. B.* 1893, p. 341.) Bambuseæ. S. A tall growing bamboo which is widely distributed in Africa, with canes 3 in. wide at the base, and lanceolate leaves 6 in. long. Introduced from Lake Nyassa by Lord de Saumarez, who presented a plant to Kew.

Pæonia lutea, Franchet. (*W. G.* 1893, p. 30.) Ranunculaceæ. G. A yellow-flowered Pæony from Yunnan. (Jardin des Plantes, Paris.)

***Pelexia maculata,** Rolfe. (*K. B.* 1893, p. 7.) Orchideæ. S. A new species with shining olive-green leaves blotched with grey above and purplish below. Scape 12 in. long, purple, clothed with sheaths and bracts and bearing green, pink-tipped flowers. Habitat not recorded. (Kew and Glasnevin.)

Pentas quartiniana, Oliv. (*W. G.* 1893, p. 143, f. 31.) Rubiaceæ. S. A variety of the old *P. carnea*, than which it is said to be finer and freer flowering. Abyssinia. (Dammann & Co., Naples.)

Phaius amabilis. (*G. C.* 1893, v. xiii., pp. 206, 226, fig. 32; *O. R.* v. i., p. 87.) Orchideæ. S. A garden hybrid between *P. grandifolius* and *P. tuberculosus*. (J. Veitch & Sons.)

Phaio-Calanthe sedeniana albiflora. (*G. C.* 1893, v. xiii., p. 80.) S. A garden hybrid between *Phaius grandifolius* and *Calanthe vestita*, var. (J. Veitch & Sons.)

Phaio-Calanthe sedeniana rosea. (*O. R.* v. i., p. 85.) S. A garden hybrid between *Calanthe Veitchii* and *Phaius grandifolius*. In the type the Phaius was the seed parent but in this variety it was the pollen parent. (J. Riley.)

Phaius Gravesii. (*G. and F.* 1893, v. vi., p. 169; *O. R.* v. i., p. 241, fig. 13.) S. A garden hybrid between *P. Wallichii* and *P. grandifolius*. *P. hybridus*, raised by D. O. Drewett in 1892 is from the same parents. (H. Graves, New Jersey.)

Phaius roseus, Rolfe. (*K. B.* 1893, p. 6.) S. A new species with lanceolate leaves a foot long, and an erect scape 15 in. long, bearing six flowers, which are 2 in. across, and coloured pale rose with white spots on the lip and the spur yellow. ? W. Trop. Africa. (Earl of Scarborough.)

Phalænopsis fugax, Kränzlin. (*G. C.* 1893, v. xiv., p. 360.) Orchideæ. S. A new species, with small green leaves and small yellowish flowers, which have the peculiar character of expanding at about 9 a.m. and fading at about 3 p.m. on the same day. Habitat not recorded. (Sir T. Lawrence.)

Phalænopsis intermedia var. **Vesta.** (*G. C.* 1893, v. xiii., p. 80; *O. R.* v. i., p. 52.) S. A garden hybrid between *P. rosea*, var. *leucaspis*, and *P. Aphrodite*. (J. Veitch & Sons.)

Philodendron notabile, Hort. (*G. C.* 1893, v. xiii., p. 414.) Aroideæ. S. A stove plant of large dimensions with a short stem and long stalked lobed leaves, the blades 2 ft. long and cordate, coloured deep green. Habitat not recorded. (W. Bull.)

[The genus of this plant is uncertain until it flowers.]

Phœnix melanocarpa, Naudin. (*G. C.* 1893, v. xiv., p. 299.) Palmæ. S. A supposed large fruited variety of *P. senegalensis*, Hort. It has black edible fruits. Said to have originated in a garden on the Riviera.

***Pholidota Lugardi,** Rolfe. (*K. B.* 1893, p. 6.) Orchideæ. S. A new species allied to *P. articulata* but larger in all its parts. The racemes are 6 in. long, pendent, and clothed with small shell-like white flowers. Western Burma. (Kew.)

Physosiphon Lindleyi, Rolfe. (*K. B.* 1893, p. 61.) Orchideæ. S. A new species near *P. Loddigesii*, with the largest flowers of any species known. Stem 2 in. long; leaves oblong obtuse, 3 in. long; scape 4 in. long, flowers ¾ in. long, green, with red sepals. Mexico. (Glasnevin.)

***Pleurothallis maculata,** Rolfe. (*K. B.* 1893, p. 334.) Orchideæ. S. A new species allied to *P. recurva*;

leaves 2 in. long, blotched with dull purple; flowers small, white and purple. Brazil. (Kew.)

***Pleurothallis pergracilis**, Rolfe. (*K. B.* 1893, p. 334.) S. A new species, allied to *P. marginata*. It has small spathulate leaves in a dense tuft, and scapes 4 in. high, bearing very small yellowish flowers with purple lines. British Honduras. (Kew.)

Pleurothallis puberula, Rolfe. (*K. B.* 1893, p. 169.) S. A new species, allied to *P. univaginata*, but the flowers are smaller and more numerous; they are coloured green and dull yellow, and are fragrant. Habitat not recorded. (Glasnevin.)

Pleurothallis rhombipetala, Rolfe. (*K. B.* 1893, p. 4.) S. A new species allied to *P. arcuata*, with lax racemes of small green and purple flowers. Mt. Roraima. (Charlesworth & Co.)

***Pleurothallis unistriata**, Rolfe. (*K. B.* 1893, p. 334.) S. A new species near *P. marginata*. Leaves only about an inch long; scape 2½ in. long, slender, bearing a few small whitish flowers with purple lines. Habitat not recorded. (Kew.)

***Polystachya Buchanani**, Rolfe. (*K. B.* 1893, p. 335.) Orchideæ. S. A new species, very similar to *P. luteola*. Leaves about 6 in. long; scapes 12 in. long, flowers small, yellowish, with faint traces of purple. E. Trop. Africa. (Glasnevin & J. O'Brien.)

Polystachya imbricata, Rolfe. (*K. B.* 1893, p. 172.) S. A new species near *P. ensifolia*. Stems and leaves each about 3 in. long, spike short, branched, bearing small yellow and pink flowers. E. Trop. Africa. (J. O'Brien.)

Polystachya lawrenciana, Kränzlin. (*G. C.* 1893, v. xiv., p. 150.) S. A new species very near to *P. laxiflora*, differing in its simple raceme and in the colour of its small flowers, which are pale lilac and green. Fernando Po. (Sir T. Lawrence.)

***Protea rhodantha**, Hook. f. (*B. M.* t. 7331.) Proteaceæ. G. A new species with a short swollen stem, twisted branches and sessile linear oblong green leaves; flower heads terminal, 3 in. across, rose coloured with orange stamens. Transvaal. (Kew.)

***Pteris serrulata**, Linn. f. var. **gigantea**, Hort. (*G. C.* 1893, v. xiii., p. 79.) Filices. S. A variety with much larger fronds than the type. Garden origin? (H. B. May.)

Pyrus angustifolia, Ait. var. **flore-pleno**. (*B. T. O.* 1893, p. 180, f.) Rosaceæ. H. This is a double-flowered form of the old *P. coronaria* (not of *P. angustifolia*).

***Richardia Lutwychei**, N. E. Br. (*G. C.* 1893, v. xiii., p. 568.) Aroideæ. G. First described as a new species but since recognised as *R. hastata*. A quantity of it was sold by auction last year under the name of "Pride of the Congo." (S. G. Lutwyche.)

***Richardia Rehmanni**, Harrow. (*G. C.* 1893, v. xiv., pp. 564, 659, 770.) G. A species which differs from all others described in having lanceolate leaf-blades and spathes more or less tinged with rose-purple. S. Africa. It has been in cultivation in Botanic Gardens several years, but has only now attracted the notice of horticulturists.

***Saccolabium mooreanum**, Rolfe. (*K. B.* 1893, p. 64.) Orchideæ. S. A new species allied to *S. Mimus*. Leaves 6 in. long, 1½ in. wide; scape 8 in. long, flowers small in a crowded short raceme, pink with green tips. New Guinea. (Glasnevin, &c.)

***Saintpaulia ionantha**, Wendl. (*Gfl.* 1893, t. 1391.) Gesneraceæ. S. A charming plant with the habit of Ramondia pyrenaica. Flowers dark violet-blue with yellow anthers. Usumbara Mountains. E. Africa. (Baron von St. Paul, Silesia.)

Salix amplexicaulis, Hort. (*Gfl.* 1893, p. 674, f. 136.) Salicineæ. H. Described in periodical named as Boissier's species, but it is *S. amplexicaulis*, Bory., and a synonym of *S. oppositifolia*, Host. Morea.

Salix blanda, Anderss. (*Gfl.* 1893, p. 378.) H. A hybrid between *S. babylonica* and *S. fragilis*. (Späth, Berlin.)

Salix nigricans, Sm. var. **moabitica**, Bolle. (*Gfl.* 1893, p. 378.) H. A dwarf form of the black willow with finely fringed leaves. (Späth, Berlin.)

Salix purpurea, Linn. var. **scharfenbergensis**, Bolle. (*Gfl.* 1893, p. 378.) H. An ornamental form of the common purple willow. (Späth, Berlin.)

Salmia laucheana, Hort. (*G. C.* 1893, v. xiii., pp. 442, 481, fig. 72.) Cyclanthaceæ. S. Salmia is sunk under *Carludovica*, and this species is near *C. plicata*. It has large ensiform, plicated, coriaceous green leaves, with bilobed apices and sheathing bases. Antioquia. (F. Sander & Co.)

***Sansevieria Kirkii,** Baker. (*K. B.* 1893, p. 186.) Liliaceæ. S. A robust growing species allied to *S. longiflora*, producing stout thick leathery leaves 9 ft. high, which yield a valuable fibre; flowers in a dense head, tubular, white. Introduced to Kew in 1881 and since distributed, but it did not flower until last summer. E. Trop. Africa. (Kew.)

***Sarcochilus muscosus,** Rolfe. (*K. B.* 1893, p. 7.) Orchideæ. S. A new species allied to *S. hirtulus*. It has a dwarf stem, distichous oblong leaves, and a short hairy scape of small yellow and purple flowers. Andaman Islands. (Kew.)

Sarracenia mandaiana. (*G. C.* 1893, v. xiii., p. 455.) Sarraceniaceæ. G. A garden hybrid between *S. flava rubra* and *S. Drummondii*. (Pitcher & Manda.)

***Satyrium sphærocarpum,** Ldl. (*B. M.*, t. 7295.) Orchideæ. G. A terrestrial species with ovate oblong acute green leaves and an erect scape 12 in. high, bearing about 20 Orchis-like flowers, 1 in. long, white with red spots and lines. S. Africa. (Kew.)

***Scaphosepalum microdactylum** Rolfe. (*K. B.* 1893, p. 335.) Orchideæ. G. A new species, near *S. ochthodes*. It has oblong fleshy leaves, 2 in. long with three apical teeth, and scapes 5 in. long, bearing small greenish-yellow and brown flowers. Habitat not recorded. (Kew.)

Schomburgkia rosea, Linden. (*O. R.*, v. i, p. 103.) Orchideæ. S. A near ally of *S. undulata*, with smaller flowers coloured dull reddish-purple, the lip being purple rose with three white keels, and the column white spotted with purple. New Granada. (B. S. Williams & Son; H. J. Ross, Florence.)

***Scilla Buchanani,** Baker. (*G. C.* 1893, v. xiii., p. 568.) Liliaceæ. G. A new species with a small globose bulb, lanceolate green leaves a foot long, and a flexuose green scape 8 in. long bearing a dense raceme of green flowers with purple filaments. Nyassaland. (Kew.)

***Scilla leucophylla,** Baker. (*G. C.* 1893, v. xiii., p. 506.) H. A very distinct Scilla resembling some of the Hyacinths of the subgenus *Bellevalia*, but the segments in the flowers are free to the base. Flowers bright purple, tipped with green. Persia. (Max Leichtlin, Baden.)

Scopolia carniolica, Jacq. var. **hladnikiana,** Fleisch. (*G. C.* 1893, v. xiii., p. 418, f. 60.) Solanaceæ. This chiefly differs from the type in having creamy yellow scentless flowers. Eastern Europe. (Geo. Paul & Son.)

***Selaginella pitcheriana,** Hort. (*G. C.* 1893, v. xiv., p. 651.) Selaginellaceæ. S. A garden name for *S. erythropus*, Spring, var. *minor*. (Pitcher & Manda.)

Selenipedium Ainsworthii, var. **delicatum.** (*O. R.* vi., p 244). Orchideæ. S. A garden hybrid between *S. longifolium*, var. *hinksianum* and *S. Sedeni candidulum*. (Captain Hincks.)

Selenipedium Phædra. (*G. C.* 1893, v. xiii., p. 80; O. R. v. i., p. 52.) S. A garden hybrid between *S. lindleyanum* and *S. Sedeni* var. *candidulum*. Syn. *Cypripedium Phædra*. (J. Veitch & Sons.)

Selenipedium pulchellum. (*O. R.* v. i., p. 106.) S. A garden hybrid between *S. grande* and *S. Sedeni candidulum*. (W. Vanner.)

***Selenipedium sargentianum,** Rolfe. (*O. R.* v. i., p. 239.) S. A new species, closely allied to *S. lindleyanum*, which it resembles in habit, foliage, and flowers, differing chiefly in having a pair of small white tubercles on the inner margin of the side lobes of the lip. Brazil. (F. Sander & Co.)

Senecio leucostachys, Baker. (*R. H.* 1893, p. 104, figs. 37, 38.) Compositæ. G. or H. H. A subshrub with white tomentose pinnatisect leaves. Uruguay. (André, France.)

Sophora japonica hybrida, Carr. (*R. H.* 1893, p. 37.) Leguminosæ. H. A tree only differing from the typical weeping Sophora in the strong horizontally-spreading main branches and in the long thin pendulous smaller ones. (Vallerand, France.)

***Sphærolobium grandiflorum,** R. Br. (*B. M.* t. 7308.) Leguminosæ. G. A handsome greenhouse plant of broom-like habit, the long rush-like branches being clothed with small linear leaves and terminated by graceful racemes of bright yellow and red flowers. W. Australia. (Kew.)

***Spiræa Bumalda,** Hort., var. **Anthony Waterer.** (*G. C.* 1893, v. xiv., p. 365, f. 57.) Rosaceæ. A form of this well-known garden plant with rich deep rose-coloured flowers. (A. Waterer.)

Stanhopea amesiana, Hort. (*G. C.* 1893, v. xiii., p. 518; *G. M.* 1893, p. 352, fig.) Orchideæ. S. A handsome plant with large white wax flowers, the lip thick and hornless. It is probably only a variety of *S. Lowii*. (H. Low & Co.)

***Stanhopea Lowii**, Rolfe. (*K. B.* 1893, p. 63; *G. C.* 1893, v. xiv., pp. 630, 689, fig. 107.) S. A striking species of the *S. ecornuta* section, and differing from *S. amesiana* in having purple spots on the hypochile, and whitish buff sepals and petals. New Grenada. (H. Low & Co.)

Stenandrium goossensianum. (*Ill. H.* 1893, t. 168.) Acanthaceæ. S. A garden hybrid with variegated leaves, green and yellow, margined with brown. (L'Horticulture Internationale.)

***Strobilanthes dyerianus**, Hort. (*G. C.* 1893, v. xiii., p. 442; *G. and F.* v. vi., p. 194; *J. of H.* v. xxvi., p. 359, fig. 66.) Acanthaceæ. S. A free growing stove plant with opposite ovate acuminate leaves, coloured, especially when young, rich rosy-purple on a dark green ground. Flowers on erect spikes, funnel-shaped, an inch long, violet-blue. East Indies. (F. Sander & Co.)

Tamarix kashgarica. (*G. C.* 1893, v. xiii., p. 414.) H. A new species, discovered by Roborowsky in Central Asia; it differs in appearance from the rest of the genus, the leaves are very small, glaucous green, adpressed and imbricated. Plant has not yet flowered in cultivation. (Lemoine, Nancy.)

***Tchichatschewa isatidea**, Boiss. (*Gard.* 1893, v. 44, p. 145.) Cruciferæ. H. A beautiful alpine; leaves dark green, beset with silky hairs. Flowers rosy-lilac, fragrant. Asia Minor. (Max Leichtlin, Baden.)

Tigridia grandiflora, Salisb. var. **liliacea**, Hort. (*G. and F.* v. vi., p. 367.) Irideæ. H. H. Supposed to be an accidental cross between *T. Pavonia* and *T. Pavonia* var. *alba*. It has reddish-purple flowers, with nearly white variegation. (F. H. Horsford, Vermont.)

Tigridia grandiflora, Salisb. var. **rosea**, Hort. (*G. and F.* v. vi., p. 367.) H. H. Supposed to be an accidental hybrid between *T. Pavonia* and *T. conchiflora*. It has yellow flowers tinged with rose. (F. H. Horsford, Vermont.)

Tilia miqueliana, Max. (*G. and F.* 1893, v. vi., p. 111, fig. 19.) Tiliaceæ. H. A species nearly related to the Eastern European *T. argentea*. (Arnold Arboretum.)

Tillandsia leodiensis. (*Gfl.* 1893, p. 340; *G. C.* 1893, v. xiii., p. 580.) Bromeliaceæ. S. A garden hybrid between *T. morreniana* and *T. Barilletii*. (In continental gardens these are called Vriesias.) (J. Veitch & Sons.)

***Tillandsia microxiphion**, Baker. (*B. M.* t. 7320.) S. A new species of the subgenus *Anoplophytum* and a near ally of *T. stricta*. It has short erect tufted stems, clothed with linear lepidote leaves 1 in. long, and terminated by an erect few-flowered spike, clothed with pink bracts and deep blue flowers. Monte Video. (Kew.)

Tillandsia xiphioides, Ker. var. **Arequitæ**, André. (*R. H.* 1893, p. 156, col. pl.) S. A fine variety with larger, whiter leaves, longer inflorescence, and more numerous and whiter flowers than the type. Uruguay. (André, France.)

***Tradescantia elongata**, Lind. (*G. C.* 1893, v. xiii., p. 474.) Commelinaceæ. S. "Leaves longer and narrower than "in *T. reginæ*, dark green with bands "of silvery white, and a dull purple "tinge down the midrib." Habitat not recorded. (L'Horticulture Internationale.)

***Tradescantia velutina**, Lind. (*G. C.* 1893, v. xiii., p. 475.) S. Leaves close, short, hairy, purple in the centre with a narrow band of silvery white on each side. Habitat not recorded. (L'Horticulture Internationale.)

***Trichocentrum albiflorum**, Rolfe. (*K. B.* 1893, p. 336.) Orchideæ. S. A new species allied to *T. candidum*. Leaves ovate, about an inch long; raceme as long as the leaves; flowers about an inch across with a short, bidentate spur, white with a tinge of purple at the base of the lip. Mexico. (Kew.)

Triteleia uniflora, Lindl. var. **cœrulea**, André. (*R. H.* 1893, p. 256, pl.) Liliaceæ. H. A form differing from the type in having porcelain blue flowers. (André, France.)

Triteleia uniflora, Lindl. var. **Stella**, Hort. Damm. (*Damm. Cat.* 1893, p. 5.) H. An improved form of the species. (Dammann & Co., Naples.)

Tulipa concinna, Baker. (*G. C.* 1893, v. xiii., p. 538.) Liliaceæ. H. A species with crimson flowers allied to *T. undulatifolia*, *T. ciliatula*, and *T. dammaniana*. Taurus. (Whittall, Smyrna.)

Tulipa Harmonia, Sprenger. (*Damm. Cat.* 1893, p. 5.) An early-flowering form of *T. undulatifolia*, with large bright scarlet flowers, having large black gold-bordered spots at the base. Taurus. (Dammann & Co., Naples.)

***Uraria crinita,** Desv. (*G. and F.* 1893, v. vi., p. 424.) Leguminosæ. S. A dwarf erect perennial with pinnate leaves not unlike those of *Wistaria*, and erect racemes of purplish-rose flowers, and conspicuous rose-coloured ciliated bracts. India and China. (Kew.)

Vallota purpurea, Herb. var. **delicata,** Hort. (*G. C.* 1893, v. xiii., p. 641.) Amaryllideæ. G. A variety with pale red flowers. (R. Veitch & Sons.)

Vanda Miss Joachim. (*G. C.* 1893 v. xiii., p. 741.) Orchideæ. S. A garden hybrid between *V. hookeriana* and *V. teres*. (Singapore Bot. Gard.)

Vanda tricolor, Lindl. var. **Hoveæ,** L. Lind. (*L.* t. 396.) S. A variety with yellowish sepals, and petals thickly spotted all over with red; the lip is rose-crimson. (L'Horticulture Internationale.)

Vanda tricolor, Lindl. var. **Wallichii,** André. (*R. H.* 1893, p. 328, pl.) S. A form with yellow ground colour spotted with red-brown, lip lilac-rose. (De la Devansaye, France.)

Verbascum wiedemannianum, Fisch. et Mey. (*G. C.* 1893, v. xiv., p. 785.) Scrophularineæ. H. A perennial species with flowers changing from indigo-blue to purplish-lilac. N. Kurdistan. (Haage & Schmidt, Erfurt.)

Verbesina pinnatifida, Hort. (*Bruant Cat.* 1893, No. 216, p. 7, fig. .) Compositeæ. G. A new introduction which grows many feet high and has large pinnatifid leaves remarkable for their elegance. Guatemala. (Bruant, Poitiers.)

***Veronica Colensoi,** Hook. f. (*G. M.* 1893, p. 269.) Scrophularineæ. H. H. A shrubby species closely allied to *V. Traversii* and bearing a profusion of small trusses of lavender-blue flowers. (New Zealand.)

***Veronica Fairfieldii,** Hook. f. (*B. M.* t. 7323.) H. H. A new species or possibly a natural hybrid closely related to *V. hulkeana*. It has short branches, ovate, toothed leaves less than an inch long, green with a brownish margin; flowers lavender coloured on short erect branched racemes. New Zealand. (Edinburgh Bot. Gard.)

***Veronica loganioides,** Armstr. (*Gard.* 1893, v. 44, p. 436.) H. A dwarf species belonging to the conifer-like section. The plant is yellowish-green in colour bearing racemes of white flowers. New Zealand. (Stansfield Bros.)

***Vitis Coignetiæ,** Planch. (*G. and F.* 1893, v. vi., p. 450.) Ampelideæ. H. Introduced into France and America a few years ago from Japan, and at first mistaken for *V. Labrusca*, Linn., which it resembles in habit and foliage. It is remarkable for the rich crimson colour assumed by its leaves in autumn. Japan.

Vriesia hybrida Pommer-Escheana, (*Gfl.* 1893, p. 129, tab. 1388.) Bromeliaceæ. S. A garden hybrid between *V. morreniana* and *V. splendens*.

Vriesia purpurascens, Hort. (*G. C.* 1893, v. xiii., p. 413.) S. A richly coloured plant, the leaves dark green flushed with purple, wholly purple on underside. Brazil. (W. Bull.)

[Until the plant flowers the genus is uncertain.]

Vriesia tesselata. Morren. var. **Sanderæ,** Hort. (*G. C.* 1893, v. xiii., p. 442.) S. A variety with leaves prettily variegated in white and yellow bands on a green tesselated ground. S. Brazil. (F. Sander & Co.)

***Wittsteinia vaccineacea,** F. v. Muell. (*K. B.* 1893, p. 112.) Ericaceæ. G. The only species known, and one of the very few representatives of the Ericaceæ in Australia. It is a sub-alpine with prostrate creeping stems and ascending branches a foot long, clothed with small thick roundish toothed leaves and small axillary yellowish or red campanulate flowers. Australia. (Kew.)

ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

APPENDIX III.—1894.

LIST of the STAFFS of the ROYAL GARDENS, Kew, and of Botanical Departments and Establishments at Home, and in India and the Colonies, in Correspondence with Kew.

* Trained at Kew. † Recommended by Kew.

Royal Gardens, Kew :—

Director - - - - W. T. Thiselton-Dyer, C.M.G., C.I.E., F.R.S., Ph.D., M.A., F.L.S.
Assistant-Director - - Daniel Morris, C.M.G., D.Sc., M.A., F.L.S.
Assistant (Office) - - *John Aikman.
" " - - *William Nicholls Winn.

Keeper of Herbarium and Library John Gilbert Baker, F.R.S., F.L.S.
Principal Assistant (Phanerogams) *William Botting Hemsley, F.R.S., A.L.S.
" " (Cryptogams) - George Massee.
Assistant (Herbarium) - - Nicholas Edward Brown, A.L.S.
" " - - *Robert Allen Rolfe, A.L.S.
" " - - Charles Henry Wright.
" " - - Sidney Alfred Skan.
" for India - - Otto Stapf, Ph.D.

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Honorary Keeper, Jodrell Laboratory - - - Dukinfield Henry Scott, F.R.S., M.A., Ph.D., F.L.S.

Curator of Museums - - John Reader Jackson, A.L.S.
Assistant (Museum) - - John Masters Hillier.
Preparer - - - George Badderly.

Curator of the Gardens - - George Nicholson, A.L.S.
Assistant Curator - - William Watson.
Foremen :—
  Arboretum - - - *William J. Bean.
  Herbaceous Department - *Walter Irving.
  Greenhouse and Ornamental Department. Frank Garrett.
  Temperate House (Sub-tropical Department). *Thomas Jones.

Cambridge.—University Botanic Garden :—
Professor - Charles C. Babington, F.R.S., F.L.S.
Deputy Professor Francis Darwin, M.B., F.R.S., F.L.S.
Curator - - *Richard Irwin Lynch, A.L.S.

Dublin.—Royal Botanic Gardens, Glasnevin :—
Keeper - - Frederick W. Moore, A.L.S.

Trinity College Botanic Gardens :—
Professor - - E. Perceval Wright, M.D., F.L.S., Sec. R.I.A.
Curator - - *F. W. Burbidge, M.A., F.L.S.

Edinburgh.—Royal Botanic Garden :—
Regius Keeper - Isaac Bayley Balfour, M.D., D.Sc., F.R.S., F.L.S.
Curator - - Robert Lindsay.

Glasgow.—Botanic Gardens :—
University Professor F. O. Bower, D.Sc., F.R.S., F.L.S.
Curator - - *Daniel Dewar.

Oxford.—University Botanic Garden :—
Professor - - Sydney H. Vines, D.Sc., F.R.S., F.L.S.
Curator - - *William Baker.

COLONIES.

Antigua. (*See* Leeward Islands.)

Barbados.—Dodd's Reformatory, Botanic Station :—

	Superintendent	John R. Bovell, F.C.S.

British Guiana.—Botanic Gardens :—

Georgetown	Superintendent and Government Botanist	*George S. Jenman, F.L.S.
	Head Gardener	†John F. Waby.
	Second „	*Robert Ward.
	Promenade Garden :—	
	Head Gardener	William Jackson.
Berbice	Keeper	Richard Hunt.

British Honduras.—Botanic Station :—

	Curator	†James McNair.

Canada.—

Ottawa	Dominion Botanist	Prof. John Macoun, M.A., F.R.S.C., F.L.S.
	Assistant „	Jas. M. Macoun.
	Director of Government Experimental Farms	Prof. Wm. Saunders, F.R.S.C., F.L.S.
	Botanist and Entomologist.	James Fletcher, F.L.S.
Montreal	Director, University Botanic Garden.	Prof. D. P. Penhallow, B.Sc.

Cape Colony.—

	Government Botanist	Prof. MacOwan, F.L.S.
Gardens and Public Parks :—		
Cape Town	Curator	H. J. Chalwin.
Grahamstown	Curator	Edwin Tidmarsh.
Port Elizabeth (St. George's Park) :—	Superintendent	John T. Butters.
King Williamstown	Curator	———
Graaf Reinet	„	J. C. Smith.
Uitenhage	„	H. Fairey.

Ceylon.—Department of Royal Botanic Gardens :—

	Director	†Henry Trimen, M.B., F.R.S., F.L.S.
Peradeniya	Head Gardener	*Peter D. G. Clark.
	Clerk	J. Ferdinandus.
	Draughtsman	W. de Alwis.
Hakgala	Superintendent	*William Nock.
	Clerk and Foreman	M. G. Perera.
Henaratgoda	Conductor	S. de Silva, Arachchi.
Anuràdhapura	„	D. F. de Silva.
Badulla	„	D. A. Guneratne.

Dominica. (*See* Leeward Islands.)

Fiji.—Botanic Station :—

	Curator	*Daniel Yeoward.

Gambia.—Botanic Station :—

	Curator	*Walter Haydon.

Gold Coast.—Botanic Station :—

	Curator	*William Crowther.

Grenada.—Botanic Garden :—

	Curator	*Walter E. Broadway.

Hong Kong.—Botanic and Afforestation Department :—

	Superintendent	†Charles Ford, F.L.S.
	Assistant Superintendent.	*W. J. Tutcher.

Jamaica.—Department of Public Gardens and Plantations :—

	Director	†William Fawcett, B.Sc., F.L.S.
Hope Gardens	Superintendent	*William Cradwick.
Castleton Garden	„	Eugene Campbell.
Cinchona (Hill Garden).	„	*William Harris.
Kingston Parade Garden.	„	John Campbell.
King's House Garden.	„	*William J. Thompson.
Bath	Overseer	W. Groves.

Lagos.—Botanic Station :—

	Curator	*Henry Millen.
	Assistant	*F. G. R. Leigh.
	„	*T. B. Dawodu.

Leeward Islands.—Agricultural Department :—

	Superintendent	†Charles A. Barber, M.A. F.L.S.

Botanic Stations :—

Antigua	Curator	*Arthur G. Tillson.
Dominica	„	*Joseph Jones.
Montserrat	Head Gardener	Henry Maloney.
St. Kitts-Nevis	„ „	Joseph Wade.

Malta.—Argotti Botanic Garden :—

	Director	Dr. Francesco Debono.

Mauritius.—Department of Forests and Botanic Gardens :—

Pamplemousses	Director	*William Scott.
	Assistant Director of Gardens.	J. Vankeirsbilck.
	Assistant Director of Forests.	P. Randabel.
Curepipe	Overseer	William A. Kennedy.

Montserrat. (*See* Leeward Islands.)

Natal.—Botanic Gardens :—

Durban	Curator	John Medley Wood, A.L.S.
	Head Gardener	*James Wylie.
Pietermaritzburg	Curator	G. Mitchell.

New South Wales.—Botanic Gardens:—

Sydney	Director	Charles Moore, F.L.S.

New Zealand:—

Wellington.—Colonial Botanic Garden:—

	Director	Sir James Hector, K.C.M.G., F.R.S.
	Head Gardener	G. Gibb.
Dunedin	Superintendent	J. McBean.
Napier	„	W. Barton.
Invercargill	Head Gardener	Thomas Waugh.
Auckland	Ranger	William Goldie.
Christchurch	Head Gardener	*Ambrose Taylor.

Niger Coast Protectorate.—Botanic Garden:—

Old Calabar	Curator	Horace W. L. Billington

Queensland.—Botanic Department:—

Brisbane	Colonial Botanist	F. M. Bailey, F.L.S.

Botanic Gardens:—

	Curator	*Philip MacMahon.
	Overseer	J. Tobin.

Acclimatisation Society's Gardens:—

	Secretary and Manager	Wm. Soutter.
	Assistant „	A. Humphrey.
Rockhampton	Superintendent	J. S. Edgar.

St. Kitts-Nevis. (*See* Leeward Islands.)

St. Lucia.—Botanic Station:—

	Curator	†John Gray.

St. Vincent.—Botanic Station:—

	Curator	*Henry Powell.

South Australia.—Botanic Gardens:—

Adelaide	Director	Maurice Holtze, F.L.S.
Port Darwin	Curator	Nicholas Holtze.

Straits Settlements.—Gardens and Forest Department:—

Singapore	Director	†H. N. Ridley, M.A., F.L.S.
	Assistant Superintendent.	*Walter Fox.
Penang	Assistant Superintendent	†Charles Curtis, F.L.S.
Malacca	„	*Robert Derry.

Perak (Kuala Kangsar).—Government Plantations:—

	Superintendent	Oliver Marks.

Tasmania.—Botanic Gardens:—

Hobart Town	Superintendent	F. Abbott.

Trinidad.—Royal Botanic Gardens:—

	Superintendent	†John H. Hart, F.L.S.
	Assistant „	*William Lunt.

Victoria.—

Melbourne	Government Botanist	Sir F. Von Mueller, K.C.M.G., F.R.S., F.L.S.

Botanic Gardens:—

	Director	W. R. Guilfoyle, F.L.S.

INDIA.

Botanical Survey.—Director, George King, M.D., LL.D., C.I.E., F.R.S., F.L.S.

Bengal, Assam, Burma; the Andamans and Nicobars; North-East Frontier Expeditions:—

Superintendent of the Royal Botanic Gardens, Calcutta	George King, M.D., LL.D., C.I.E., F.R.S., F.L.S.

Bombay, including Sind:—

———	———

Madras: the State of Hyderabad and the State of Mysore:—

Government Botanist and Director of Cinchona Plantations	†M. A. Lawson, M.A., F.L.S.

Western Provinces and Oudh; the Punjab; the Central Provinces; Central India; Rajputana; North-West Frontier Expeditions:—

Director of the Botanic Department Northern India, Saharanpur, N.W.P.	†J. F. Duthie, B.A., F.L.S.

Bengal.—Department of Royal Botanic Gardens:—

Calcutta (Seebpore)	Superintendent	George King, M.D., LL.D., C.I.E., F.R.S., F.L.S.
	Curator of Herbarium	Dr. David Prain, F.L.S., F.R.S.E.
	„ Garden	*Robert L. Proudlock.
	Assistant „	*G. T. Lane.
Mungpoo	Superintendent, Government Cinchona Plantations	George King, M.D., LL.D., C.I.E., F.R.S., F.L.S.
	Deputy „	*J. A. Gammie.
	1st Assistant	*R. Pantling.
	2nd „	*Joseph Parkes.
	3rd „	G. A. Gammie.
	4th „	*Amos Hartless.

Darjeeling; Lloyd Botanic Garden:—

Curator	*William A. Kennedy.

Darbhangah; Maharajah's Garden:—

Superintendent	Herbert Thorn.

Bombay.—

Poona	———	———
	Lecturer on Botany	*G. Marshall Woodrow.

Ghorpuri.—Botanic Garden:—

Superintendent	A. R. Lister.

Bombay.—Municipal Garden:—

Superintendent	C. D. Mahaluxmivala.

Central Provinces.—

Nagpur	Superintendent of Public Gardens.	*J. R. Ward.

Madras.—Botanic Department:—

Ootacumund	Government Botanist and Director of Government Gardens, Parks, and Cinchona Plantations	†M. A. Lawson, M.A., F.L.S.
	Curator of Gardens and Parks.	*Andrew Jamieson.

Madras.—Agri-Horticultural Society:—

	Hon. Secretary	Col. H. W. H. Cox.
	Superintendent	*J. M. Gleeson.

Native States.—

Mysore (Bangalore)	Superintendent	*J. Cameron, F.L.S.
	Curator	*J. Horne Stephen.
Baroda	Superintendent	*G. H. Krumbiegel.
	„ New Works	*J. M. Henry.
Gwalior	„	†C. Maries, F.L.S.
Morvi	„	*Joseph Beck.
Travancore(Trivandrum)	„	*Frederick James Ingleby.
Udaipur	„	*T. H. Storey.

North-West Provinces.—

Agra (Taj Garden)	Superintendent	F. J. Bullen.
Allahabad	„	*J. Phillips.
Cawnpur	„	G. H. T. Mayer.
Lucknow	„	*Matthew Ridley.
Saharanpur and Branch Garden, Mussoorie.	„	William Gollan.

Punjab:

Lahore	Superintendent	H. G. Hein.
Simla	„	*A. Parsons.